MOHAWK

INSTALLATION & OPERATION MANUAL

MP-18-24VDC-SERIES

ELECTRIC/HYDRAULIC
PORTABLE LIFT
2, 4, 6 & 8 POST ARRANGEMENTS

MOHAWK RESOURCES LTD.
65 VROOMAN AVENUE
P. O. BOX 110
AMSTERDAM, NY 12010
TOLL FREE: 1-800-833-2006
FAX: 1-518-842-1289
LOCAL: 1-518-842-1431

Mohawk File: MP-18-24VDC
Series 12-18-2013.doc
Rev: 12-18-2013
Part No.: 601-800-373

**READ MANUAL THOROUGHLY BEFORE INSTALLING,
OPERATING OR SERVICING THIS LIFT!!
Deliver these instructions to lift owner/user/employer along with other instructional materials furnished with this lift.**

IMPORTANT SAFETY INSTRUCTIONS

When using this garage equipment, basic safety precautions should always be followed, including the following:

1. **Read all instructions.**
2. Inspect lift daily. Do not operate if it malfunctions or problems have been encountered.
3. Never attempt to overload the lift. The manufacturer's rated capacity is shown on the identification label on the power side column. Do not override the operating controls or the warranty will be void.
4. Only trained and authorized personnel should operate the lift. Do not allow customers or bystanders to operate the lift or be in the lift area.
5. Position the lift support forks to contact the vehicle tires. Raise the lift until the forks contact the tires. Check forks for secure contact with the vehicle tires, then raise the lift to the desired working height.
6. NOTE: Always use all 4 posts to raise and support vehicle.
7. Note that the removal or installation of some vehicle parts may cause a critical load shift in the center of gravity and may cause the vehicle to become unstable. Refer to the vehicle manufacturer's service manual for recommended procedures.
8. Always keep the lift area free of obstructions and debris. Grease and oil spills should always be cleaned up immediately.
9. Never raise vehicle with passengers inside.
10. Before lowering check area for any obstructions.
11. Before driving vehicle between the posts, position the lift forks to allow vehicle to freely enter lifting area. To not hit or run over forks as this could damage the lift and/or the vehicle.
12. Before removing the vehicle from the lift area, position the lift forks to allow vehicle to freely leave lifting area. To not hit or run over forks as this could damage the lift and/or the vehicle.
13. Care must be taken as burns can occur from touching hot parts.
14. Do not operate equipment with a damaged cord or if the equipment has been dropped or damaged – until a qualified serviceman has examined it.
15. Do not let cords hang over tables, benches or counters or come in contact with hot manifolds or moving fan blades.
16. If an extension cord is necessary, a cord with a current rating equal to or more than that of the equipment should be used. Cords rated for less current than the equipment may overheat. Care should be taken to arrange the cord so that it will not be tripped over or pulled.
17. Always unplug the equipment from electrical outlet when not in use. Never use the cord to pull the plug from the outlet. Grasp plug and pull to disconnect.
18. Let equipment cool completely before pulling away. Loop cord loosely around equipment when storing.
19. To reduce the risk of fire, do not operate equipment in the vicinity of open containers of flammable liquids (gasoline).
20. Adequate ventilation should be provided when working on operating internal combustion engines.
21. Keep hair, loose clothing, fingers, and all parts of body way from moving parts.
22. To reduce the risk of electrical shock, do not use on wet surfaces or expose to rain.
23. Use only as described in this manual. Use only manufacturer's recommended attachments.
24. **ALWAYS WEAR SAFETY GLASSES**. Everyday eyeglasses have only impact resistant lenses, and they are NOT safety glasses.

SAVE THESE INSTRUCTIONS

MP-18 24VDC- Series Model Name Matrix:

Mohawk Model Name	Number of Posts:	Total Lift Capacity (lbs):	---------- Fork Lengths ----------			
			Post 1&2	Post 3&4	Post 5&6	Post 7&8
MP-18-505	2	36,000	15"	N/A	N/A	N/A
MP-18-509	2	32,000	22"	N/A	N/A	N/A
MP-18-513	2	32,000	22"W	N/A	N/A	N/A
MP-18-506	4	72,000	15"	15"	N/A	N/A
MP-18-518	4	68,000	15"	22"	N/A	N/A
MP-18-530	4	68,000	15"	22"W	N/A	N/A
MP-18-510	4	64,000	22"	22"	N/A	N/A
MP-18-514	4	64,000	22"W	22"W	N/A	N/A
MP-18-507	6	108,000	15"	15"	15"	N/A
MP-18-524	6	104,000	15"	15"	22"	N/A
MP-18-558	6	104,000	15"	15"	22"W	N/A
MP-18-525	6	100,000	15"	22"	22"	N/A
MP-18-559	6	100,000	15"	22"W	22"W	N/A
MP-18-511	6	96,000	22"	22"	22"	N/A
MP-18-515	6	96,000	22"W	22"W	22"W	N/A
MP-18-508	8	144,000	15"	15"	15"	15"
MP-18-526	8	140,000	15"	15"	15"	22"
MP-18-560	8	140,000	15"	15"	15"	22"W
MP-18-527	8	136,000	15"	15"	22"	22"
MP-18-561	8	136,000	15"	15"	22"W	22"W
MP-18-528	8	132,000	15"	22"	22"	22"
MP-18-562	8	132,000	15"	22"W	22"W	22"W
MP-18-512	8	128,000	22"	22"	22"	22"
MP-18-516	8	128,000	22"W	22"W	22"W	22"W

Notes:

All Posts with 15" Forks are Rated 18,000 lbs each.

All Posts with 22" Forks are Rated 16,000 lbs each.

W - Denotes Wider Fork Lifts

The Automotive Lift Institute (ALI) is a trade association comprised of US and Canadian manufacturers and certain national distributors of automotive lifts. For almost 50 years, the ALI in cooperation with the American National Standards Institute (ANSI) has continued to sponsor the national standard ANSI/ALI ALCTV:2011 "Safety Requirements for Construction, Testing, and Validation for Automotive Lifts."

The new "ALI/ETL Automotive Lift Certification Program" is based on ALI developed methods and criteria for third party testing of automotive lifts to validate conformance with ANSI/ALI ALCTV:2011.

For automotive lifts to be certified, manufacturers must execute an agreement with the ALI and ETL / Intertek Testing Services and must meet certain requirements:

- Must be structurally tested in accordance with the test requirements as outlined in ANSI/ALI ALCTV:2011.
- All motor operated units must be listed by a nationally recognized testing laboratory (NRTL) in accordance with ANSI/UL-201.
- The manufacturer's production facility must meet quality control requirements as set forth in the ANSI Z34.1-1987 and the ALI/ETL Automotive Lift Certification Program Procedural Guide.
- All manufacturer-provided instructions, manuals, and operator safety documents, must meet the requirements of the ANSI/ALI ALCTV:2011 and ANSI/UL-201.

Lifts meeting these rigid requirements may be listed in the directory of certified lifts and be labeled with the "ALI/ETL certification mark" (Above on right), and, if applicable, the ETL listing mark to ANSI/UL-201.

Mohawk has been a long-standing member of ALI and most of Mohawk's popular models are currently listed and certified. Other Mohawk models are in various stages of testing. To obtain a complete and current certification listing, contact Mohawk Resources Ltd. or visit **www.mohawklifts.com** or **www.ali-directory.org** To obtain a copy of the current automotive lift standard, contact ALI or ANSI or visit **www.autolift.org**

Some people purchase quality products and others do not. You are assured of quality when you purchase a Mohawk product in compliance with the certification program.

HAVE A QUESTION?

Call your local
Mohawk distributor
For parts, service and technical support.

Distributor Place Card Here

Please have this unit's model and serial number when calling for service.

Model Number _____

Serial Number _____

OR CONTACT:

MOHAWK RESOURCES LTD.
65 Vrooman Ave.
P.O. Box 110
Amsterdam, NY 12010
Toll Free: 1-800-833-2006
Local: 1-518-842-1431
Fax: 1-518-842-1289
Internet: www.MOHAWKLIFTS.com
E-Mail: Service@MOHAWKLIFTS.com

MOHAWK WARRANTIES

EFFECTIVE DATE: **8/1/2013***

GENERAL WARRANTY INFORMATION:

MOHAWK'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIRING OR REPLACING ANY PART OR PARTS RETURNED TO THIS FACTORY, TRANSPORTATION CHARGES PREPAID, WHICH PROVE UPON INSPECTION TO BE DEFECTIVE AND WHICH HAVE NOT BEEN MISUSED. DAMAGE OR FAILURE TO ANY PART DUE TO FREIGHT DAMAGE OR LACK OF REQUIRED REGULAR DOCUMENTED MAINTENANCE IS NOT COVERED UNDER THIS WARRANTY. ALL WARRANTY CLAIMS MUST BE PERFORMED IN ACCORDANCE TO MOHAWK'S WARRANTY PARTS RETURN POLICY (CONTACT MOHAWK'S SERVICE DEPARTMENT FOR MORE INFORMATION).

THIS WARRANTY DOES NOT COVER MIS-DIAGNOSING OF UNIT OR PARTS RETURNED THAT ARE NON-DEFECTIVE. THIS WARRANTY DOES NOT COVER ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES INCLUDING, BUT NOT LIMITED TO, LOST REVENUES OR BUSINESS HARM. THIS EQUIPMENT HAS BEEN DESIGNED FOR USE IN NORMAL COMMERCIAL VEHICLE MAINTENANCE APPLICATIONS. A SPECIFIC INDIVIDUAL WARRANTY MUST BE ISSUED FOR UNITS THAT DEVIATE FROM INTENDED USAGE, SUCH AS HIGH CYCLE USAGE IN INDUSTRIAL APPLICATIONS, OR USAGE IN EXTREMELY ABUSIVE ENVIRONMENTS, ETC. MOHAWK RESERVES THE RIGHT TO DECLINE RESPONSIBILITY WHEN REPAIRS HAVE BEEN MADE OR ATTEMPTED BY OTHERS. THIS WARRANTY DOES NOT COVER LABOR. THIS WARRANTY DOES NOT COVER DOWNTIME EXPENSES INCURRED WHEN UNIT IS IN REPAIR. THE LIFT MUST BE REGISTERED WITHIN 30 DAYS OF INSTALLATION BY MAILING SUPPLIED WARRANTY REGISTRATION CARD TO MOHAWK AND MUST BE SIGNED BY A LICENSED ELECTRICIAN. THE MODEL NAME AND SERIAL NUMBER OF THE EQUIPMENT MUST BE FURNISHED WITH ALL WARRANTY CLAIMS. THIS WARRANTY STATEMENT CONTAINS THE ENTIRE AGREEMENT BETWEEN MOHAWK RESOURCES LTD. AND THE PURCHASER UNLESS OTHERWISE SPECIFICALLY EXPRESSED IN WRITING. THIS NON-TRANSFERABLE WARRANTY APPLIES TO THE ORIGINAL PURCHASER ONLY. THIS WARRANTY IS APPLICABLE TO UNITS LOCATED ONLY IN THE UNITED STATES OF AMERICA AND CANADA. CONTACT MOHAWK RESOURCES LTD. FOR SPECIFIC WARRANTY PROVISIONS FOR UNITS LOCATED OUTSIDE OF THESE COUNTRIES.

THIS WARRANTY DOES NOT COVER NORMAL SURFACE WEAR ITEMS, ITEMS SUBJECT TO ABRASION, OR ITEMS USED IN A CORROSIVE ENVIRONMENT. SOME ITEMS ON LIFT ARE SUBJECT TO NORMAL "WEAR AND TEAR" AND ARE NOT COVERED UNDER THIS WARRANTY.

STRUCTURAL COMPONENTS (ALL LIFTS):

STRUCTURAL AND MECHANICAL COMPONENTS OF THIS UNIT ARE GUARANTEED FOR THE BELOW STATED TIME FRAME, SPECIFIC TO MODEL LISTED, FROM THE DATE OF SHIPMENT FROM FACTORY, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN LIFT IS INSTALLED AND USED ACCORDING TO SPECIFICATIONS.

25-YEARS STRUCTURAL / 10 YEARS MECHANICAL: MODELS A-7, SYSTEM IA-10, LC-12, LC-12-3SA, LMF-12, TP-16, TP-18, TP-20, TP-26, TP-30. STRUCTURAL ITEMS COVERED INCLUDE LEG, CARRIAGE, SWING ARM AND SLIDER WELDMENTS (EXCLUDING NORMAL WEAR AREAS AS STATED ABOVE). MECHANICAL ITEMS COVERED INCLUDE ROLLER BEARINGS AND LIFTING CHAIN.

5-YEAR: MODELS TL-7.
3-YEAR: MODELS TR-19, TR-25, FL-25, TR-30, TR-33, TR-35, TR-50, TR-75, TR-110, TR-120, MP-SERIES, RP-SERIES LIFTS.
2-YEAR: MODELS PARALLELOGRAM SERIES LIFTS.
1-YEAR: MODELS TD-1000, TD-2000, CT-1000, USL-6000.

POWER UNIT (ALL LIFTS):

ALL POWER UNIT COMPONENTS (MOTOR, PUMP AND RESERVOIR) ARE GUARANTEED FOR TWO YEARS FOR PARTS, FROM THE DATE OF SHIPMENT FROM FACTORY, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN THE LIFT IS INSTALLED, CONNECTED BY A LICENSED ELECTRICIAN AND USED ACCORDING TO SPECIFICATIONS.

ELECTRICAL COMPONENTS (ALL LIFTS):

ALL ELECTRICAL COMPONENTS (EXCLUDING MOTOR) ARE GUARANTEED FOR ONE YEAR FOR PARTS, FROM THE DATE OF SHIPMENT FROM FACTORY, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN THE LIFT IS INSTALLED AND USED ACCORDING TO SPECIFICATIONS.

PNEUMATIC-AIR COMPONENTS (ALL LIFTS):

ALL PNEUMATIC (AIR) COMPONENTS (I.E. AIR CYLINDERS AND POPPET AIR VALVES) ARE GUARANTEED FOR ONE YEAR FOR PARTS, FROM THE DATE OF SHIPMENT FROM FACTORY, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN THE LIFT IS INSTALLED AND USED ACCORDING TO SPECIFICATIONS.

HYDRAULIC CYLINDERS (MODEL SPECIFIC LIFTS):
THE FOLLOWING MODELS ARE GUARANTEED FOR 5 YEARS (PARTS ONLY), FROM DATE OF SHIPMENT FROM FACTORY, FOR HYDRAULIC CYLINDERS, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN THE LIFT IS INSTALLED AND USED ACCORDING TO SPECIFICATIONS: A-7, SYSTEM IA-10, LC-12, LC-12-3SA, LMF-12, TP-16, TP-18, TP-20, TP-26, TP-30.

ALL OTHER MODELS ARE GUARANTEED FOR TWO YEARS (PARTS ONLY), FROM THE DATE OF SHIPMENT FROM FACTORY, FOR HYDRAULIC CYLINDERS, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN THE LIFT IS INSTALLED AND USED ACCORDING TO SPECIFICATIONS (EXCLUDING USL-6000, WHICH IS ONE YEAR).

AFTER THE FIRST 5 YEARS FROM DATE OF SHIPMENT FROM FACTORY, THE "*EXTENDED LIFETIME CYLINDER SEAL WARRANTY*" (BELOW) IS APPLICABLE TO THE FOLLOWING MOHAWK LIFTS ONLY: A-7, SYSTEM IA-10, LC-12, LC-12-3SA, LMF-12, TP-16, TP-18, TP-20, TP-26, TP-30. SEE MOHAWK'S "*EXTENDED LIFETIME CYLINDER SEAL WARRANTY*" FOR SPECIFIC WARRANTY PROVISIONS FOR HYDRAULIC CYLINDERS.

THE "***EXTENDED LIFETIME CYLINDER SEAL WARRANTY***" IS AS FOLLOWS:

AS THE ORIGINAL PURCHASER OF A MOHAWK LIFT MANUFACTURED BY MOHAWK RESOURCES, LTD. YOU ARE ENTITLED TO AN EXTENDED CYLINDER SEAL WARRANTY. TO QUALIFY FOR THIS WARRANTY, THE FOLLOWING CONDITIONS MUST BE MET:

ALL LIFTS MUST BE REGISTERED WITH MOHAWK RESOURCES, LTD., P.O. BOX 110, 65 VROOMAN AVENUE, AMSTERDAM, NY 12010, WITH THE ORIGINAL CUSTOMER NAME, ADDRESS AND PHONE NUMBER, WITHIN 30 DAYS OF INSTALLATION. (USE POSTAGE PAID WARRANTY REGISTRATION CARD ATTACHED TO THE FRONT OF THE MANUAL PROVIDED.)

MOHAWK'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO SUPPLYING MODEL SPECIFIC CYLINDER SEALS. THE CUSTOMER IS RESPONSIBLE FOR SHIPPING AND HANDLING OF THE SEALS. MOHAWK IS NOT RESPONSIBLE/LIABLE FOR THE REBUILD OF CYLINDERS BY OTHERS. THIS WARRANTY IS NON-TRANSFERABLE AND RUNS TO THE ORIGINAL PURCHASER ONLY.

STANDARD OPTIONS (ALL LIFTS):
ALL STANDARD OPTIONS OF THIS UNIT ARE GUARANTEED FOR ONE YEAR FOR PARTS, FROM THE DATE OF SHIPMENT FROM FACTORY, AGAINST DEFECTS IN WORKMANSHIP AND/OR MATERIALS WHEN LIFT IS INSTALLED AND USED ACCORDING TO SPECIFICATIONS.

CUSTOM LIFTS AND OPTIONS:
ALL "CUSTOM" LIFTS AND/OR "CUSTOM" OPTIONS ARE GUARANTEED ON A CASE-BY-CASE BASIS. CONSULT MOHAWK FACTORY FOR DETAILS ON SPECIFIC CUSTOM LIFTS AND/OR OPTIONS.

WARRANTY EXCEPTIONS (ALL LIFTS):
ADJUSTMENTS: THIS WARRANTY DOES NOT COVER CASUAL AND ROUTINE ADJUSTMENTS SUCH AS, BUT NOT LIMITED TO: FITTINGS, ANCHOR BOLT RE-TIGHTENING, OR ANY SHIMMING OR ADJUSTMENTS REQUIRED DURING A PROPER AND PROFESSIONAL INSTALLATION BY A QUALIFIED INSTALLER.
MAINTENANCE AND INSPECTIONS: IF THIS UNIT IS NOT MAINTAINED AND INSPECTED IN ACCORDANCE TO THE RELEVANT SECTIONS IN THE USERS MANUAL FOR THIS SPECIFIC MODEL, WARRANTY IS VOID. OSHA, ANSI AND MOHAWK REQUIRE THAT RECORDS MUST BE MAINTAINED TO PROVE THAT INSPECTIONS AND MAINTENANCE OF THIS UNIT HAVE BEEN ROUTINELY PERFORMED BY QUALIFIED INDIVIDUALS.
ABUSE: IF THIS UNIT IS FOUND TO BE OVERLOADED (PURPOSELY OR UNKNOWINGLY), USED IN A SITUATION BEYOND ITS INTENDED FUNCTION, NOT MAINTAINED OR INSPECTED REGULARLY, OR USED IN AN ABUSIVE ENVIRONMENT OR BEYOND NORMAL SHOP USAGE, ETC., THIS WARRANTY IS VOID IN ITS ENTIRETY.
NON-EXISTENT PROBLEMS: FOR SERVICE VISITS, PART REPLACEMENTS, LABOR, ETC. FOR PARTS FOUND TO BE NON-DEFECTIVE, OR FOR A UNIT DIS-FUNCTION THAT DOES NOT EXIST, IT IS THE LIFT OWNER THAT REQUESTED THE SERVICE VISIT WHO BEARS THE RESPONSIBILITY OF ALL RELATED EXPENSES.
BATTERIES: ALL BATTERIES CARRY THE BATTERY MANUFACTURER'S WARRANTY. MAINTENANCE REQUIREMENTS AND ABUSE PROVISIONS ARE AS STATED BY THE BATTERY MANUFACTURER. REFER TO BATTERY MANUFACTURER'S WARRANTY.
SPECIAL/MODIFIED INSTALLATIONS: THIS WARRANTY DOES NOT COVER "NON-TRADITIONAL" INSTALLATIONS. INSTALLATIONS ARE TO BE DONE ACCORDING TO SPECIFICATIONS, OR THE WARRANTY IS VOID.
WEARABLE COMPONENTS: SOME ITEMS ON LIFTS ARE SUBJECT TO NORMAL "WEAR AND TEAR" AND ARE NOT COVERED UNDER THIS WARRANTY.

*** THIS WARRANTY SUPERSEDES ALL OTHER WARRANTY POLICIES PREVIOUSLY STATED AND IN ALL OTHER MOHAWK PRODUCT SPECIFIC LITERATURE (MANUALS, BROCHURES, ETC.).**

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PARTS

	DWG NO.
POST ASSEMBLY (15” FORKS)	MP-5400-A-001
POST ASSEMBLY (22” FORKS)	MP-5400-A-004
JACK ASSEMBLY	MP-0400-A-007
POWER UNIT ASSEMBLY	MP-5400-A-003
FLOOR ROLLER ASSEMBLY	MP-0500-A-001
LOCK ASSEMBLY	MP-5200-A-001
CARRIAGE ASSEMBLY	MP-0700-A-001
CYLINDER ASSEMBLY	MP-0900-A-001
CONTROL BOX ASSEMBLY	MP-5100-A-001
CONTROL BOX SUB-ASSEMBLY	MP-5100-A-003
CONTROL PANEL ASSEMBLY	MP-5100-A-004
TERMINAL STRIP #1 ASSEMBLY	MP-5100-A-020
TERMINAL STRIP #2 ASSEMBLY	MP-5100-A-021
CHARGER ASSEMBLY	MP-5100-A-012
STRING POT ASSEMBLY	MP-5100-A-014
BATTERY BOX ASSEMBLY	MP-5300-A-001
PENDANT ASSEMBLY (OPTIONAL)	MP-1300-A-020

ILLUSTRATIONS

CHARGER STATUS LIGHTS
BATTERY METER LIGHTS
JACK OPERATION
JACK RELIEF SETTING
ENCLOSURE DIAGRAMS
COMMUNICATION CABLE & DUMMY PLUG DIAGRAMS
WARNINGS PICTOGRAM
CAUTIONS PICTOGRAM
SAFETY INSTRUCTIONS PICTOGRAM

SCHEMATICS

	DWG NO.
HYDRAULIC SCHEMATIC	MP-5000-A-002
ELECTRICAL SCHEMATIC & WIRING DIAGRAMS (3 PAGES)	MP-5000-A-001

CHARGER

CHARGER INFORMATION

BATTERY CARE

BATTERY INFORMATION

OPTIONS

ALL INFORMATION, ILLUSTRATIONS, AND SPECIFICATIONS IN THIS MANUAL ARE BASED ON THE LATEST PRODUCT INFORMATION AVAILABLE AT THE TIME OF PRINTING. WE RESERVE THE RIGHT TO MAKE CHANGES AT ANY TIME WITHOUT NOTICE.

GENERAL NOTES & WARNINGS

RECOMMENDATIONS BY THE INDIVIDUAL USER OR USING ORGANIZATION FOR IMPROVING THIS PUBLICATION OR ANY ASPECT OF THE PRODUCT ARE ENCOURAGED AND SHOULD BE FORWARDED IN WRITING TO:
MOHAWK RESOURCES LTD, SERVICE DEPT, 65 VROOMAN AVENUE, AMSTERDAM, NY 12010

THIS IS NOT A VEHICLE LIFTING PROCEDURE MANUAL AND NO ATTEMPT IS MADE OR IMPLIED HEREIN TO INSTRUCT THE USER IN LIFTING METHODS PARTICULARLY TO THE INDIVIDUAL APPLICATION OF THE EQUIPMENT DESCRIBED IN THIS MANUAL. RATHER, THE CONTENTS OF THIS MANUAL ARE INTENDED AS A BASE LINE FOR OPERATION, MAINTENANCE, TROUBLE SHOOTING, AND PARTS LISTING OF THE UNIT AS IT STANDS ALONE AND AS IT IS INTENDED AND ANTICIPATED TO BE USED IN CONJUNCTION WITH OTHER EQUIPMENT.

PROPER APPLICATION OF THE EQUIPMENT DESCRIBED HEREIN IS LIMITED TO THE PARAMETERS DETAILED IN THE SPECIFICATIONS AND THE USES SET FORTH IN THE DESCRIPTIVE PASSAGES. ANY OTHER PROPOSED APPLICATION OF THIS EQUIPMENT SHOULD BE DOCUMENTED AND SUBMITTED IN WRITING TO MOHAWK RESOURCES LTD. FOR EXAMINATION. THE USER ASSUMES FULL RESPONSIBILITY FOR ANY EQUIPMENT DAMAGE, PERSONAL INJURY, OR ALTERATION OF THE EQUIPMENT DESCRIBED IN THIS MANUAL OR ANY SUBSEQUENT DAMAGES.

DO NOT WELD, APPLY HEAT, OR MODIFY THIS EQUIPMENT IN ANY MANNER WITHOUT WRITTEN AUTHORIZATION FROM MOHAWK RESOURCES LTD. CERTAIN ALLOY OR HEAT-TREATED COMPONENTS MAY BE DISTORTED OR WEAKENED, RESULTING IN AN UNSAFE CONDITION. MOHAWK RESOURCES LTD. IS NOT RESPONSIBLE FOR DISTORTIONS, WHICH RESULT FROM WELDING ON THIS EQUIPMENT AFTER MANUFACTURING IS COMPLETED. UNAUTHORIZED WELDING, APPLICATION OF HEAT, OR MODIFICATION OF THIS EQUIPMENT VOIDS ANY AND / OR ALL APPLICABLE WARRANTIES COVERING THIS EQUIPMENT.

ALL WARRANTIES APPLICABLE TO THIS EQUIPMENT ARE CONTINGENT ON STRICT ADHERENCE TO THE MAINTENANCE SCHEDULES AND PROCEDURES IN THIS MANUAL.

KEEP ALL SHIELDS AND GUARDS IN PLACE. ENSURE ALL SAFETY MECHANISMS ARE OPERABLE. KEEP HANDS, FEET, AND CLOTHING AWAY FROM POWER-DRIVEN AND MOVING PARTS.

WARNING

DO NOT INSTALL THIS UNIT IN A PIT OR DEPRESSION DUE TO FIRE OR EXPLOSION RISK

IMPORTANT NOTE

A LEVEL FLOOR IS SUGGESTED FOR A PROPER INSTALLATION SITE AND WILL ENSURE LEVEL LIFTING. ANY MAJOR SLOPE CHANGES WILL AFFECT THE UNIT'S LEVEL LIFTING PERFORMANCE. IF A FLOOR IS OF QUESTIONABLE SLOPE, CONSIDER A SURVEY OF THE SIGHT AND / OR THE POSSIBILITY OF POURING A NEW LEVEL CONCRETE SLAB SECTION. SIMPLY STATED, FOR OPTIMUM LEVEL LIFTING, THE EQUIPMENT, AT BEST, CAN LIFT ONLY AS LEVEL AS THE FLOOR ON WHICH IT IS LOCATED... AND SHOULD NOT BE EXPECTED TO COMPENSATE FOR DRASTIC FLOOR SLOPE DIFFERENCES.

THIS EQUIPMENT MUST BE USED ON A LEVEL **CONCRETE FLOOR WITH A MINIMUM THICKNESS OF 4-1/2" ON GRADE**. THE CONCRETE MUST BE AGED AT LEAST (28) **TWENTY EIGHT** DAYS PRIOR TO INSTALLATION AND HAVE A MINIMUM COMPRESSIVE STRENGTH OF **3000 PSI**. DO NOT USE THIS UNIT ON ANY ASPHALT SURFACE.

DO NOT USE THIS UNIT ON A SECOND FLOOR OR ANY GROUND FLOOR WITH A BASEMENT BENEATH WITHOUT WRITTEN AUTHORIZATION FROM THE BUILDING ARCHITECT.

CAUTION

THE EQUIPMENT DESCRIBED IN THIS MANUAL COULD BE POTENTIALLY DANGEROUS IF IMPROPERLY OR CARELESSLY OPERATED. FOR THE PROTECTION OF ALL PERSONS AND EQUIPMENT, ONLY COMPETENTLY TRAINED OPERATORS WHO ARE CRITICALLY AWARE OF THE PROPER OPERATING PROCEDURES, POTENTIAL DANGERS, AND SPECIFIC APPLICATION OF THIS EQUIPMENT SHOULD BE ALLOWED TO TOUCH THE CONTROLS AT ANY TIME.

SAFE OPERATION OF THIS EQUIPMENT IS DEPENDENT ON USE, IN COMPLIANCE WITH THE OPERATION PROCEDURES OUTLINED IN THIS MANUAL ALONG WITH THE MAINTENANCE AND INSPECTION PROCEDURES WITH CONSIDERATION OF PREVAILING CONDITIONS.

THIS LIFT IS DESIGNED AND INTENDED **FOR USAGE AND STORAGE INDOORS ONLY**. MOHAWK DENIES ALL LIABILITY AND VOIDS WARRANTY IN SITUATIONS WHERE THIS LIFT IS USED OR STORED WHERE IT IS SUBJECTED TO THE OUTDOOR ELEMENTS AND TEMPERATURES.

THE EQUIPMENT DESCRIBED IN THIS MANUAL IS NEITHER DESIGNED NOR INTENDED FOR ANY APPLICATION ALONE OR IN CONJUNCTION WITH ANY OTHER EQUIPMENT THAT INVOLVES THE LIFTING OR MOVING OF **PERSONS.**

ALWAYS CONSULT THE VEHICLE LIFTING GUIDE FOR THE PROPER LIFTING POINTS ON ANY VEHICLE. THESE GUIDES ARE AVAILABLE FROM THE VEHICLE MANUFACTURERS. ALSO, REFER TO THE ANSI STANDARD "VEHICLE LIFT POINTS FOR SERVICE GARAGE LIFTING," ANSI/SAE J2184-OCT92, SAFETY MANUAL "LIFTING IF RIGHT," ALI/SM01, AND "VEHICLE LIFTING POINTS GUIDE" ALI/LP-GUIDE FOR PROPER POSITIONING OF VEHICLES ON LIFT.

AFTER LIFTING THE VEHICLE TO THE DESIRED HEIGHT, ALWAYS LOWER THE UNIT ONTO THE MECHANICAL SAFETIES. THE FORMING OF GOOD OPERATIONAL WORK HABITS WILL ELIMINATE OVERSIGHTS IN THE USE OF PROVIDED SAFETY DEVICES.

APPENDAGE:

Rev (9/1/2012)

LIFT ENVIRONMENT LIMITATIONS:

Mohawk prohibits the outdoor installation of this standard lift, which is APPROVED FOR INDOOR USAGE ONLY, in a normal garage type environment. Any concerns in applications that expose the lift to additional environmental effects, such as paint booths, wash bays, outdoors, high or low temperatures, etc. must be addressed to our engineering department, where provisions could/may be made to the lift to accommodate the area of use. Our engineering department must be made aware in advance of these conditions and any additional code requirements that must be met.

Also, the foundation for which this lift must be installed on must comply to the minimum specifications as set forth in this manual. Any drainage slopes in the bay where the lift is to be installed must be directed away from the posts to prevent water accumulation at the post bases.

Standard floor requirements are contained within this manual. For installation within a seismic area, a qualified person must be consulted to address seismic loads and other local or state requirements.

LOCKOUT/TAGOUT REQUIREMENTS:

The start switch provided with this unit must not be used as a primary disconnecting means. A separate disconnecting means must be provided in accordance with all applicable codes. It is the responsibility of the owner/user of this unit to provide a proper lockout/tagout device for this unit before or during installation in conformance to ANSI Z244.1 and any local/state/national electrical codes and any OSHA regulations.

OTHER LIFT LIMITATIONS:

All Mohawk MP-Series lifts must accomplish three main criteria in order to lift a vehicle safely:

1. **Proper capacity.** All MP-Series lifts are designed to lift standard vehicles within their rated capacity within the capacity of the lift rating. Any vehicles exceeding the capacity must not be raised. Ensure that individual columns are used within their capacity and are not overloaded (ie. heavy ended vehicles may overload the rear pair of columns).
2. **Proper engagement of tires/frame:** ensure tires are fully engaging all tires or proper frame components of vehicle. Ensure frame components used are capable of supporting vehicle.
3. **Proper flooring.** Use lifts on floors complying to required specs stated within this manual.

This lift is not intended to be driven on or off of, as this may damage the lift and the vehicle.
This lift is not intended for the lifting of people.

Care must be observed when removing any heavy components from a vehicle and thereby drastically shifting the vehicle center of gravity (i.e. engine removal, transmission removal, etc.). The use of jack stands at the front and rear ends of the vehicle is highly recommended when performing this type of work.

File: MP-Appen.doc

POWER SUPPLY REQUIREMENTS

This lift comes with (2) 12 VDC batteries in series to provide a 24 VDC system. A separate 120 VAC power supply is only required when charging the post. Each post comes equipped with a 120 VAC, 60 HZ receptacle which accepts a 120 VAC extension cord. The minimum amp draw is 3 amps per post. Use sizes of plug, cord and power supply as follows:

Plug Requirements:
NEMA Type 5-15 (Female), 125 VAC, 2 Pole, 3 Wire Grounding, 15 Amp Rated.

Cord Requirements:
3 Wire, 125 VAC, 15 Amp Rated, Oil Resistant, Type G, SO, STO, or W. (Maximum Length is 50 feet)

Power Requirements:
115-120 VAC, 2 Pole, 3 Wire Grounding, 60 Hz, 3 Amps minimum per post. Size circuit breaker to NEC and local codes.

WARNING: Keep in mind that branching extension cords between posts will multiply the amp draw.
(i.e. 6 posts will collectively draw 18 amps).

NOTE THAT THESE POSTS WILL NOT OPERATE AND CHARGE AT THE SAME TIME. REMOVE THE POWER LEADS TO THE CHARGER RECEPTACLE PRIOR TO LIFT USAGE.

OPTIONAL EQUIPMENT

Note: Refer to Option Equipment Section in the back of this manual for specific user instructions for option available for this lift.

The standard mobile lift is suitable to lift wheeled vehicles by the tires. It normally comes in pairs of columns totaling 2, 4, 6 or 8 column systems. Ordering additional **dummy plugs** may enable one lift to be used in a variety of combinations simultaneously.

A **hand control pendant** is available and can be connected to any column.

If it is desired to raise the vehicle by the frame, this can be done by using optional **chassis lifting beams** or optional **frame contact adapters**. The chassis lift beam fits into the cradle where the tire would normally fit and spans between a pair of columns. Frame contact adapters convert a pair of mobile lift columns into a 2-column frame engaging lift. Refer to the ANSI standard "Vehicle Lift Points for Service Garage Lifting," ANSI/SAE J2184-Oct92, safety manual "Lifting if Right," ALI/SM01, and "Vehicle Lifting Points Guide" ALI/LP-Guide for proper positioning of vehicles on lift.

If it is desired to raise fork trucks, a **fork truck adapter kit** is available, which converts a pair of mobile lift columns into a 2-column pad engaging lift.

For lifting applications involving side wing plows or RV's with side extensions, where the forks of the mobile lifts can not reach to the tires, **wing plow adapters** are available. These adapters span between a pair of columns to achieve engagement of the tires in the same manner of the column forks.

For lifting of vehicles with dual tires, floatation tires, or "super singles", **longer forks** are available. Note that the longer fork lifts have reduced capacity.

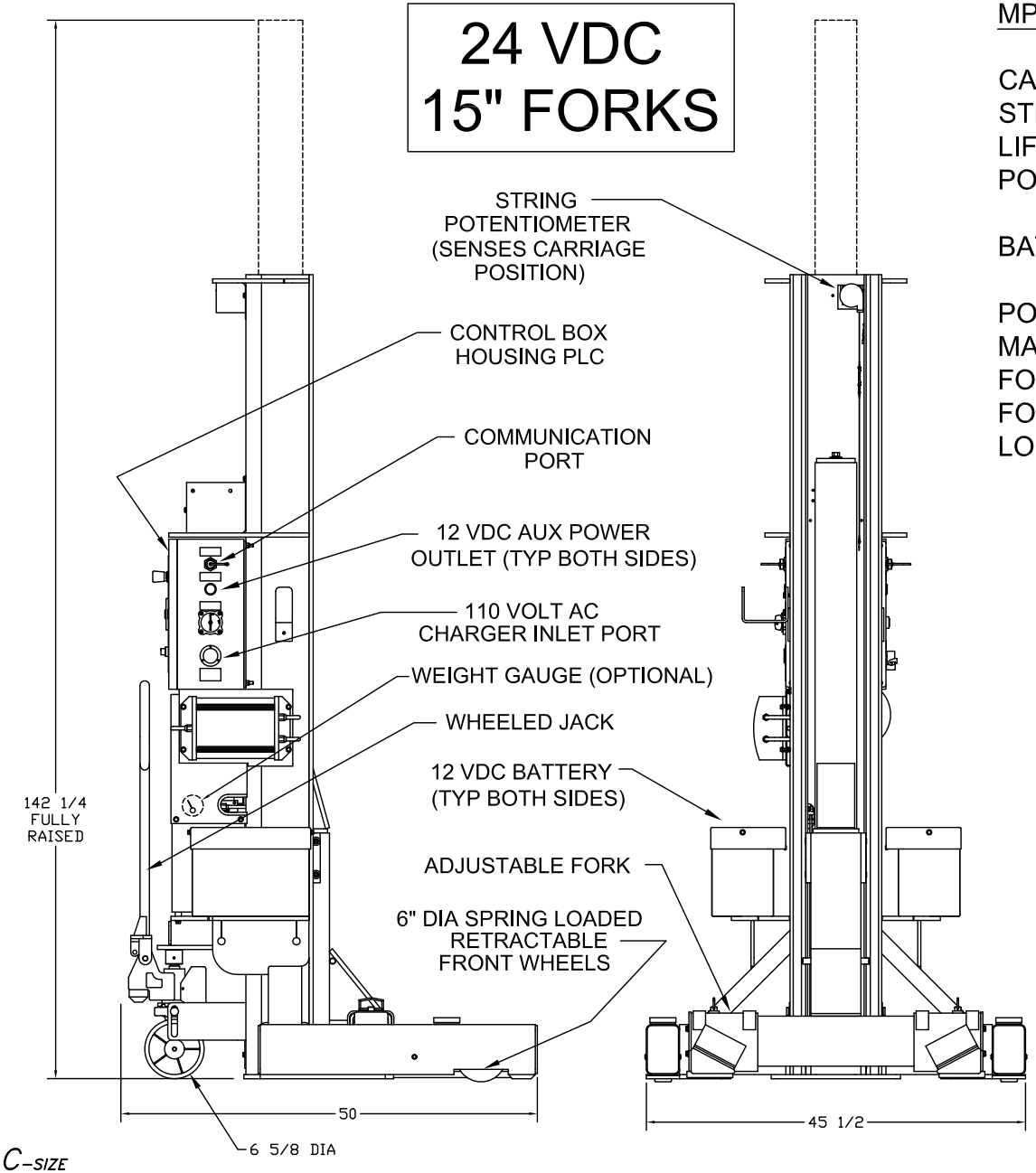
Jack Stands are also available that support the vehicle in the raised position for maintenance or to permit using the lift for other vehicles.

NOTE:
The use of any adapters on this lift may reduce the capacity of this lift. Refer to the capacities of the adapters used.

WARNING!

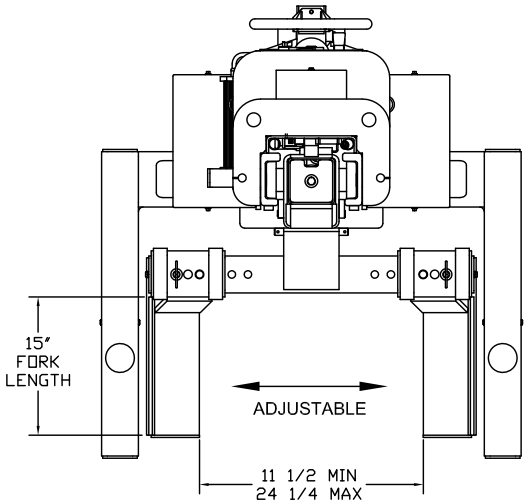
Use only options manufactured by MOHAWK RESOURCES LTD with this lift. Options manufactured by others and used on this lift may result in bodily harm, damage to lift and other equipment, and will void lift warranty, Mohawk Resources Ltd liability, and the ALI certification of the lift.

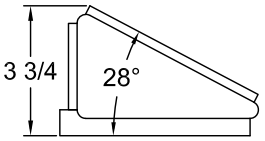
24 VDC 15" FORKS



MP-18 (24 VDC) SERIES POST SPECIFICATIONS:

CAPACITY:	18,000 LB EACH
STROKE:	67 INCHES
LIFTING SPEED:	90 SECONDS (VARIES W/ LOAD)
POWER REQUIRED:	120 VAC, 4 AMPS PER POST (FOR CHARGING BATTERIES)
BATTERY SPEC:	(2) 12 VDC DEEP CYCLE SEALED - MAINTENANCE FREE
POST QUANTITY:	2, 4, 6 OR 8
MAX TIRE SIZE:	48 INCH DIA
FORK LENGTH:	15 INCH
FORK WIDTH:	11 1/2 INCH MIN, 24 1/4 MAX
LOCK POSITIONS:	19 POSITIONS @ 3" INTERVALS STARTING @ 12"





FORK DETAIL

C-SIZE

NOTICE OF CONFIDENTIAL INFORMATION

INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPERTY OF MOHAWK RESOURCES LTD.. WHERE DRAWING IS FURNISHED TO OTHERS IT SHALL BE USED SOLELY FOR PURPOSES OF INSPECTION, INSTALLATION, OR MAINTENANCE. THE INFORMATION SHALL NOT BE USED OR DISCLOSED BY THE RECIPIENT FOR ANY OTHER PURPOSES WHATSOEVER.

NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70TI CODE 5.3 FLUX CORE WIRE ONLY.

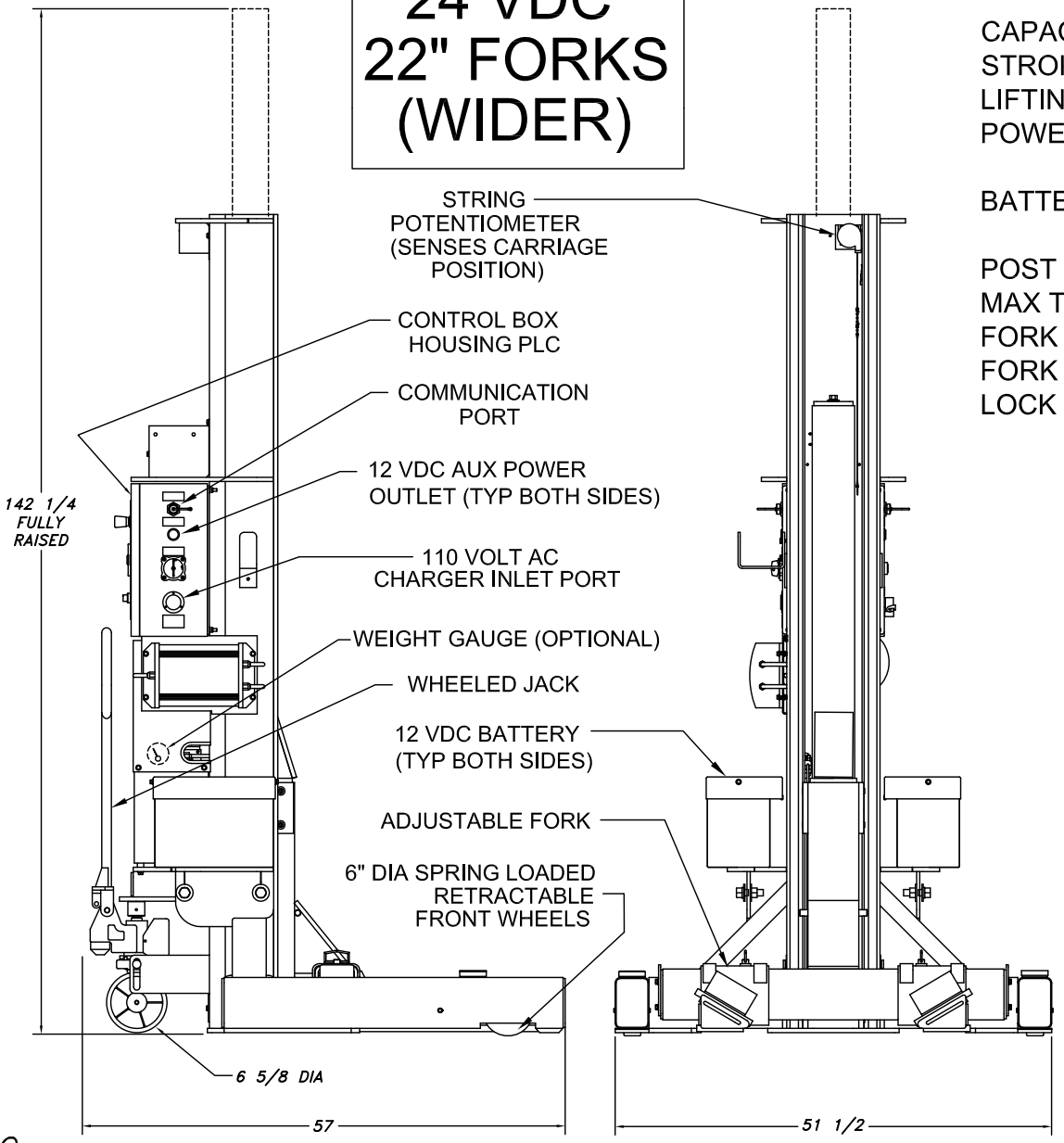
TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME MP-5400-A-002.dwg

NEXT ASSEMBLY

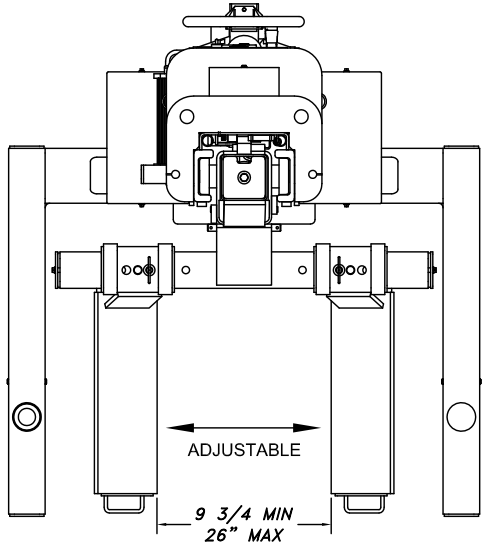
SCALE N/A	DRAWN rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE MP-18 (24VDC) w/15" Forks Specification Drawing	
DATE	WEIGHT LB.	FROM n/a	DRAWING NUMBER MP-5400-A-002

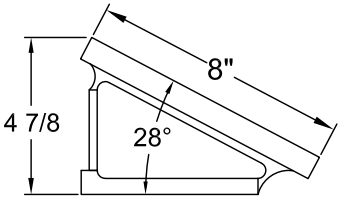
24 VDC 22" FORKS (WIDER)



MP-18 (24 VDC) SERIES POST SPECIFICATIONS:

CAPACITY:	16,000 LB EACH
STROKE:	67 INCHES
LIFTING SPEED:	90 SECONDS (VARIES W/LOAD)
POWER REQUIRED:	120 VAC, 4 AMPS PER POST (FOR CHARGING BATTERIES)
BATTERY SPEC:	(2) 12 VDC DEEP CYCLE SEALED - MAINTENANCE FREE
POST QUANTITY:	2, 4, 6 OR 8
MAX TIRE SIZE:	53 INCH DIA
FORK LENGTH:	22 INCH
FORK WIDTH:	9 3/4 INCH MIN, 26" MAX
LOCK POSITIONS:	19 POSITIONS @ 3" INTERVALS STARTING @ 12"





FORK DETAIL

C-SIZE

NOTICE OF CONFIDENTIAL INFORMATION

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NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70TI CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5400-A-016.dwg

NEXT ASSEMBLY

SCALE: N/A	DRAWN: rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE: MP-18 (24VDC) w/22" Forks Specification Drawing	
DATE	WEIGHT: LB.	FROM: n/a	DRAWING NUMBER: MP-5400-A-016

DESIGN AND CONSTRUCTION

The standard mobile lift is suitable to lift wheeled vehicles by the tires. It normally comes in pairs of columns totaling 2, 4, 6 or 8 column systems. Each column consists of a rigid frame of three-wheel design for maneuverability, lifting carriages with tire forks, control panel, electric-hydraulic power unit, and hydraulic cylinder.

Two of the wheels are spring loaded and in fixed positions on the column base. The third wheel is steerable and hydraulically operated, permitting movement of the unloaded columns, but allowing the column to sit firmly on the floor before a load is applied.

Since this lift is battery powered, each post is identical except for post identification (Post ID), and each has communication outlets to attach to the other posts, forming configurations from 2 posts all the way up to 8 posts (see lift setup).

When the lift is raised or lowered in the "synchronized" mode the actual movement of each carriage is measured and compared by each post's PLC (programmed logic controller). If the movement of any carriage exceeds that of any other carriage in the system, the carriage is slowed down or stopped until the others catch up.

The each post houses the same controls, enabling the user to control the whole lift, a single post or a post-pair combo at any post desired.

A hydraulic cylinder, powered by an electric-hydraulic pump unit, controls the carriage movement. There is an internal relief valve on the pump unit, which prevents overloading of the carriage.

A separate automatically engaging back-up mechanical safety lock latch prevents lowering of the carriage in the event of failure of the hydraulic system.

All movement controls are of the "vigilance control" type which are operable only as long as the operator is depressing the button. As soon as the button is released the motion will stop.

All columns have controls for synchronized or individual column movement, plus an "Emergency Stop".

Depressing the Emergency Stop button will stop all columns immediately and will not permit any column movement until the depressed button is reset.

MOBILE LIFT SET-UP

THOROUGHLY READ THIS SECTION BEFORE OPERATING THE LIFT. IF YOU HAVE ANY QUESTIONS, GET THEM ANSWERED BEFORE PROCEEDING. REFER TO ANSI/ALI ALIS "SAFETY REQUIREMENTS FOR INSTALLATION AND SERVICE OF AUTOMOTIVE LIFTS."

1. Be sure that the floor is strong enough to support the lift before operating. Do not use the lift on asphalt surfaces, as the lift will sink (cause depressions in the asphalt) if the vehicle is on the lift for any extended period of time. Minimum recommended flooring is 4 ½" thick concrete with 3000 psi compressive strength on grade.

   If it is necessary to use the lift on an asphalt surface, it is recommended to use a steel plate, a minimum thickness of 3/8" (8mm) which extends a minimum of 6" on all sides beyond the support points of the base of the lift. This will minimize sinking effect if the vehicle is raised for an extended period of time.

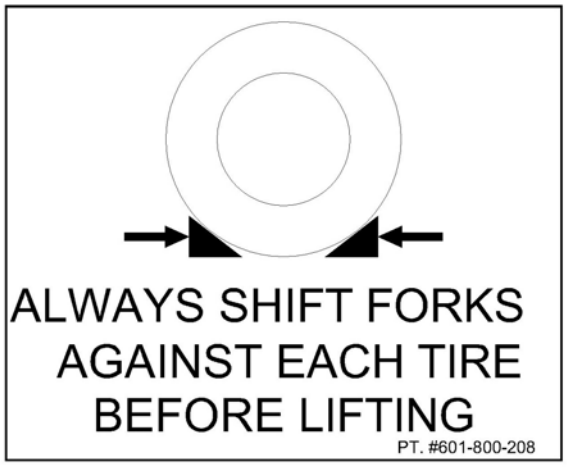
2. Be sure that the surface of the floor is relatively flat. If there is a slope of more than 3 degrees (1 inch decline over 20") do not operate the lift. Relocate to a flatter surface.

3. Verify adequate ceiling clearance to raise the vehicle without the top of the vehicle coming in contact with any obstruction. If necessary, measure the lowest point to determine how high you can raise the vehicle. Minimum height required is the tallest vehicle height plus 67". NOTE: the maximum lifting height of these columns is an adjustable setting in the PLC. Contact the factory if you wish to lower the lifting height for a low ceiling or other overhead obstructions.

4. Drive the vehicle to the working spot. Do not drive the vehicle over the cables of the lift. The cables should be arranged in a "U" shape around the entry of the vehicle or the cables should be disconnected and stored before moving the vehicle.

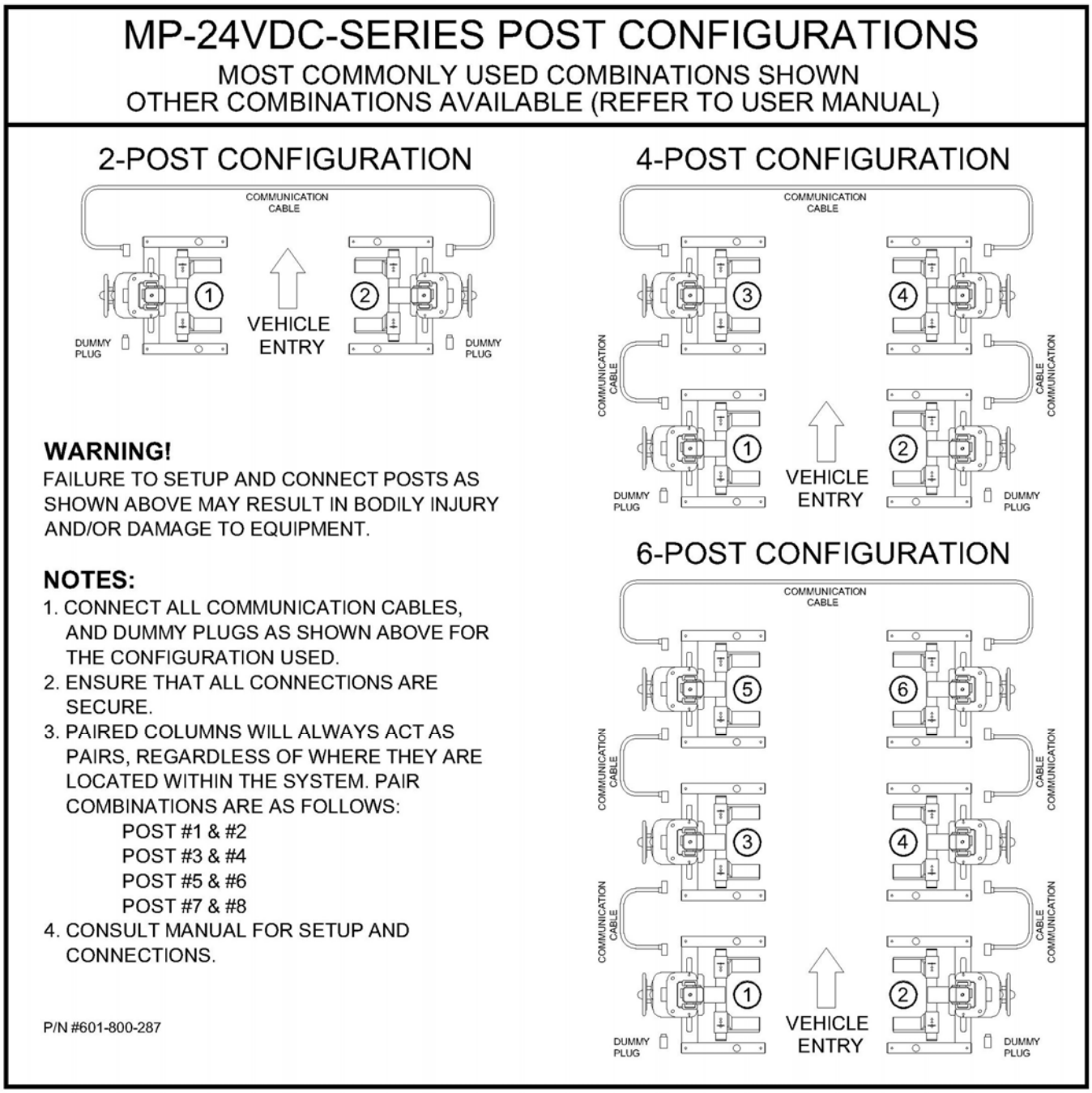
5. Unplug all power leads to chargers on all posts.

6. Ensure posts pairs are opposite each other at each axle (Post Pairs are 1&2, 3&4, 5&6, 7&8). Push the cradle forks of each post around each tire. Be sure to push them in as far as possible. The wheel rim should be larger than the opening in between the forks. See figure below. Ensure that fork pins are placed in holes at fork tubes.



7. Press the release lever to lower all jacking wheels on back of all posts after positioning.

8. Connect the communication cables from post to post in a daisy-chain fashion. For example: Posts 1 to 3 to 4 to 2 for a 4-post setup. Place dummy plugs (male and female ends) at the posts at the end of the chain. (See figure below) Note: This lift indicates what posts are communicating within the system at start up. (Refer to Explanation of Computer System – System Activation Section)


MP-24VDC-SERIES POST CONFIGURATIONS
MOST COMMONLY USED COMBINATIONS SHOWN
OTHER COMBINATIONS AVAILABLE (REFER TO USER MANUAL)
2-POST CONFIGURATION
COMMUNICATION CABLE
DUMMY PLUG
VEHICLE ENTRY
DUMMY PLUG
WARNING!
FAILURE TO SETUP AND CONNECT POSTS AS SHOWN ABOVE MAY RESULT IN BODILY INJURY AND/OR DAMAGE TO EQUIPMENT.
NOTES:
1. CONNECT ALL COMMUNICATION CABLES, AND DUMMY PLUGS AS SHOWN ABOVE FOR THE CONFIGURATION USED.
2. ENSURE THAT ALL CONNECTIONS ARE SECURE.
3. PAIRED COLUMNS WILL ALWAYS ACT AS PAIRS, REGARDLESS OF WHERE THEY ARE LOCATED WITHIN THE SYSTEM. PAIR COMBINATIONS ARE AS FOLLOWS:
POST #1 & #2
POST #3 & #4
POST #5 & #6
POST #7 & #8
4. CONSULT MANUAL FOR SETUP AND CONNECTIONS.
P/N #601-800-287
4-POST CONFIGURATION
COMMUNICATION CABLE
COMMUNICATION CABLE
CABLE COMMUNICATION
DUMMY PLUG
VEHICLE ENTRY
DUMMY PLUG
6-POST CONFIGURATION
COMMUNICATION CABLE
COMMUNICATION CABLE
CABLE COMMUNICATION
COMMUNICATION CABLE
CABLE COMMUNICATION
DUMMY PLUG
VEHICLE ENTRY
DUMMY PLUG

MOBILE LIFT OPERATION

1. Perform Lift Setup as stated in previous section.

2. Disengage all E-STOP buttons at each post by turning them clockwise to release them. Turn on the main switch for each post to "OPERATE LIFT". The display will light up to indicate the post power is on. Repeat for each post in the system. Notice that the displays will indicate which posts are communicating in the system. Verify this configuration to continue operation. The system is now ready to operate.

3. **SINGLE WHEEL OPERATION**
   Go to each wheel and engage each tire with the forks. To raise only a single wheel, turn the selector switch to SINGLE at the post that control is desired, while pressing the RAISE button. The SINGLE operation is to be used only to initially engage the tires and for slight equalization adjustments.

   During lift operation, if single wheel lifting, lowering or parking is desired, turn the selector switch to SINGLE at the post that control is desired, while pressing the RAISE button.
   BE VERY CAREFUL WHEN DOING THIS OPERATION THAT THE VEHICLE REMAINS STABLE AND THAT THE SIDE OF THE VEHICLE DOES NOT COME IN CONTACT WITH THE COLUMN.

   NOTE: If the SINGLE switch is released while the UP or DOWN button is still pressed the hoist will operate in default ALL synchronized mode (All posts will be controlled).

4. **RAISING ALL WHEELS**
   The lift controls default to controlling ALL the columns in the system (selector switch is spring returned to ALL). Press the RAISE button to raise the lift. Keep the pressure on the button until the vehicle is raised to the desired position. If necessary, use a second person to observe the area not seen by the operator.

5. **PARKING ALL WHEELS (ON MECHANICAL LOCKS)**
   The lift controls default to controlling ALL the columns in the system. Press the PARK button to lower the lift onto the mechanical locks. Keep the pressure on the button until the vehicle is completely lowered onto the locks. If necessary, use a second person to observe the area not seen by the operator.

6. **LOWERING ALL WHEELS**
   The lift controls default to controlling ALL the columns in the system. Press the LOWER button to lower the lift. Keep the pressure on the button until the vehicle is lowered to the desired position. If necessary, use a second person to observe the area not seen by the operator.

   NOTE: If lift is in park position (on mechanical locks), you will have to raise lift off of locks first, then lower. Lift will not automatically rise off of locks when pressing lower.

   NOTE: IF FOR ANY REASON, THE LIFT BECOMES INOPERATIVE IN THE RAISED POSITION WITH A VEHICLE ON IT, CONTACT YOUR LOCAL MOHAWK REPRESENTATIVE OR THE MOHAWK FACTORY.

7. **PAIR OPERATION**
   To raise, lower or park only a pair of wheels, turn the selector switch to PAIR at the post pair that control is desired, while pressing the RAISE, LOWER or PARK button.

   NOTE: Be sure that the set of wheels on the ground is free to move as the effective distance between the front and rear wheels becomes less as one pair of wheels is higher or lower than the other pair. Keep the height difference between pairs as low as practical.

   NOTE: If the PAIR switch is released while the UP or DOWN button is still pressed the hoist will operate in default ALL synchronized mode (All posts will be controlled).

LIFTING EXAMPLE:

Now that all the setup and operations instructions have been presented, an example of a typical lifting application is shown:

A mechanic is to perform maintenance on a school bus. He drives the vehicle into the bay. He then unplugs any power cables to the charger inlets on all of the posts to be used. He jacks each post with the pallet jack and moves them to each of the tires in the post configuration shown in the setup diagram. Pushing the posts firmly against the tires, he checks to ensure that the forks are slid inward as far as possible to engage the tires. He presses the pallet jack release on each column. He then connects the communication cables and dummy plugs to all the posts as shown in the setup diagram.

He is now ready to use the lift. He turns the main switch to "Operate Lift" and releases the E-Stop Button on each post of the system. Once this is done, all the displays should illuminate. He reads the post communication screen to verify that all the columns are present and accounted for on the display. He presses the appropriate button on the screen to verify the post set-up. The lift system is now ready to operate.

The mechanic then goes to each post and presses UP and SINGLE for a short moment to engage each tire with the forks until the spring loaded wheels of the post retract and the post feet are flattened on the floor. (The SINGLE function is to be used for slight adjustments and to initially engage the tires ONLY). The mechanic then presses UP and raises the vehicle to the desired height. Then the PARK button is pressed and held until the vehicle stops on the mechanical locks.

The mechanic is now able to work on the vehicle. Once done, he presses UP to lift the vehicle off of the mechanical locks. The DOWN button is pressed to lower the lift to the ground. If any adjustments where made (like SINGLE or PAIR) which made the lift level vary from the floor level, the lift may experience a fault when lowered to the floor. Pressing RESET will clear this fault and allow further lowering. Also, reversing the adjustments by pressing SINGLE or PAIR will allow the user to lower the lift fully to the floor.

Once vehicle is fully lowered, cables are stored and posts are jacked up and pulled away.

LIFT FINAL CHECKOUT (AFTER INSTALLATION):
REV (9/1/2012)

THIS PROCEDURE OUTLINES THE FINAL CHECKS TO MAKE AFTER INITIAL INSTALLATION OF THE LIFT UNIT. REPEAT THIS PROCEDURE IF THE LIFT IS RELOCATED.

AFTER THE LIFT IS FULLY ASSEMBLED, RAISE THE LIFT EMPTY A FEW TIMES TO VERIFY:

- PROPER POWER INPUT TO ALL POSTS (NOT APPLICABLE TO DC COLUMNS)
- PROPER COMMUNICATION OF ALL POSTS IN SYSTEM
- POST RECOGNITION OF ALL POSTS IN SYSTEM
- ALL POSTS RAISING SMOOTHLY AND ALL SYNCHRONIZED
- NO LEAKS PRESENT AT ANY FITTING JUNCTIONS
- LOCKS ARE ENGAGING ON ALL POSTS SIMULTANEOUSLY AS LIFT IS RAISING
- LOCKS ARE DIS-ENGAGING ON ALL POSTS WHEN LOWERING BUTTON DEPRESSED.
- LOCKS ARE RE-ENGAGING AFTER DIS-ENGAGED.
- LIFT IS NOT DRIFTING DOWN WHEN RAISED (RAISE LIFT, THEN STOP, AND VERIFY DRIFT DOWN OF CYLINDERS)
- NO VIBRATIONS FROM LOOSE CLAMPING, ETC.

ONCE THIS IS COMPLETE, LOCATE A REPRESENTATIVE VEHICLE INTO THE LIFTING AREA.
USE A VEHICLE THAT WEIGHS AT LEAST 50 PERCENT OF THE CAPACITY OF THE LIFT.
OBSERVING LIFTING PROCEDURES CONTAINED IN THIS MANUAL TO POSITION THE VEHICLE ONTO THE LIFT.

RAISE LIFT APPROXIMATELY 1 FOOT. VERIFY THE FOLLOWING:

- ALL POSTS RAISING SMOOTHLY AND ALL SYNCHRONIZED
- NO LEAKS PRESENT AT ANY FITTING JUNCTIONS
- LOCKS ARE ENGAGING ON ALL POSTS SIMULTANEOUSLY AS LIFT IS RAISING (SOME VARIANCE EXPECTED)
- LIFT IS NOT DRIFTING DOWN WHEN RAISED (RAISE LIFT, THEN STOP, AND VERIFY DRIFT DOWN OF CYLINDERS)
- NO VIBRATIONS FROM LOOSE CLAMPING, ETC.

PRESS PARK. VERIFY THE FOLLOWING:

- ALL POSTS LOWERING ONTO LOCKS

RAISE LIFT A FEW INCHES, THEM PRESS LOWER. VERIFY THE FOLLOWING:

- ALL POSTS LOWERING SMOOTHLY AND ALL SYNCHRONIZED
- NO LEAKS PRESENT AT ANY FITTING JUNCTIONS
- NO VIBRATIONS FROM LOOSE CLAMPING, ETC.
- LOCKS ARE NOT RE-ENGAGING WHILE LOWERING

RAISE LIFT TO FULL STROKE. VERIFY THE FOLLOWING:

- ALL POSTS RAISING SMOOTHLY AND ALL SYNCHRONIZED
- NO LEAKS PRESENT AT ANY FITTING JUNCTIONS
- LOCKS ARE ENGAGING ON ALL POSTS SIMULTANEOUSLY AS LIFT IS RAISING (SOME VARIANCE EXPECTED)
- LIFT IS NOT DRIFTING DOWN WHEN RAISED (RAISE LIFT, THEN STOP, AND VERIFY DRIFT DOWN OF CYLINDERS)
- NO VIBRATIONS FROM LOOSE CLAMPING, ETC.

LOWER LIFT ONTO LOCKS. VERIFY THE FOLLOWING:

- ALL LOCKS ARE ENGAGING UPON DESCENT
- PROPER SYNCHRONIZATION OF TRACKS

RAISE LIFT 3 INCHES, THEN LOWER VEHICLE TO FLOOR. VERIFY THE FOLLOWING:

- ALL POSTS LOWERING SMOOTHLY AND ALL SYNCHRONIZED
- NO LEAKS PRESENT AT ANY FITTING JUNCTIONS
- NO VIBRATIONS FROM LOOSE CLAMPING, ETC.
- LOCKS ARE NOT RE-ENGAGING WHILE LOWERING

ENSURE THAT ALL MANUALS AND OTHER INSTRUCTIONAL MATERIALS ARE DELIVERED TO OWNER/USER/EMPLOYER.
ENSURE THAT USERS ARE INSTRUCTED IN THE SAFE AND PROPER USER OF THE LIFT.
THIS ENDS THE FINAL CHECKOUT OF LIFT.

File: Final Checkout MP-Series.doc

AUTOMOTIVE LIFT SAFETY TIPS

Post these safety tips where they will be constant reminder to your lift operator.
For information specification to the lift, always refer to the lift manufacturer's manual

1. Inspects your lift daily. Never operates if it malfunctions or if it has broken or damaged parts. Repairs should be made with original equipment parts.
2. Operating controls are designed to disengage when released. Do not block closed or override them.
3. Never overload your lift. Manufacturers rated capacity is shown on nameplate affixed to the lift.
4. Positioning of the vehicle and operation of the lift should be done only by trained and authorized personnel.
5. Never raise vehicle with anyone inside it. Customers or bystanders should not be in the lift. During operation.
6. Always keep lift area free of obstructions, grease, tools, trash and other debris.
7. While working under the vehicle, lift should always be set on mechanical locking devices.
8. Note that with some vehicles, the removal (or installation) of components may cause a critical shift in the centre of gravity and results in raised vehicle instability. Refer to the vehicle manufacturer's service manual for recommended procedures when vehicle components are removed.
9. Before lowering lift, be sure tool trays, stands, etc. are removed from under the vehicle. Release locking devices before attempting to lower lift.
10. Before removing vehicle from lift area, remove posts to provide and unobstructed exit .

These "Safety Tips" along with "Lifting it Right" a general lift safety manual, are presented as an industry service by the Automotive Lift Institute. For more information on this topic, writes to ALI, PO Box 85, Cortland, NY 13045

MAINTENANCE INSTRUCTIONS

1. The channel sections where the carriage bearings ride against should be cleaned and lubricated twice a year (once every 6 months) using a light lubricant (WD-40). The channel sections where the slide blocks ride against should be cleaned and lubricated twice a year (once every 6 months) using a light lubricant (WD-40).

2. The main carriage bearings are factory lubricated and do not require any additional periodic lubrication. However, if additional lubrication is desired on these under the customer's own inspection and maintenance program, it is recommended to use CAM2 – Multipurpose #2 Grease (Part No. 86035) or equivalent. Use approximately 2 oz. per bearing.

3. Weekly, or whenever the hoist is used after any extended down time, the communication cables should be checked to make sure that there are no nicks or cuts which may reduce or compromise the insulation. Use a de-greasing cleaner to clean all cables so they maintain their visibility (Ensure cables are disconnected when cleaning them and do not spray cleaner on end connections). Also, check visually the hydraulic line connections for leaks and tighten or repair as necessary.

4. Check your hydraulic fluid annually. Every five years the hydraulic fluid should be changed using new Dexron III ATF. Drain the reservoir tank only when the carriage is in the lowered position. Fill with 3.25 US gallons per reservoir.

5. Every three months check snap rings on wheels and carriage lock. Apply a light coating of lubricant to pins as needed (WD-40).

6. In case of electrical break down have qualified service personnel service the lift using only factory direct replacement parts.

7. Call your Distributor or Factory direct if you have any questions with regards to operating the lift or need of replacement parts.

NOTE:

ONLY TRAINED LIFT SERVICE PERSONNEL ARE PERMITTED TO REPLACE WORN OR BROKEN PARTS.

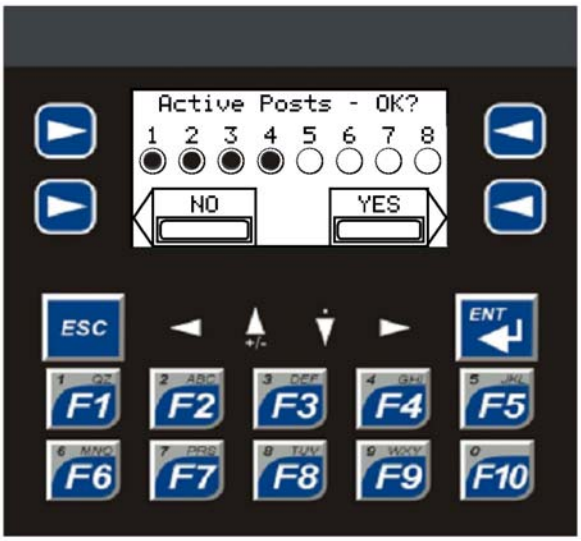
REPLACE FAULTY PARTS WITH GENUINE MOHAWK RESOURCES LTD. FACTORY DIRECT PARTS ONLY.

EXPLANATION OF COMPUTER SYSTEM

SYSTEM ACTIVATION

All posts on this system are identical (there is no master or slave columns). After the posts are connected as described in the lift setup, the lift is ready to be activated. As each post is turned on, they "search" for each other, establishing a shared network for synchronizing and controlling the lift as a system.

The first thing the user must do to operate the lift is to verify that the network is detecting the desired number of columns to use. Pressing the selection key arrow to the right of "YES" will allow the user to begin raising and lowering the lift.



Example Screen shows lift with 4 posts present in system, Post #1, #2, #3, and #4. Pressing the right selection key arrow will activate lift.

Post presence will be affected by how many posts are connected in the system, if they are connected properly (see lift setup), if the dummy plugs are connected properly (see lift setup), and if they are turned on (to "Operate Lift").

OPERATION OF SYNCHRONIZED LIFTING OR LOWERING

Each PLC (programmable logic controller) is "addressed" which establishes its identity on the network. For example, post #1 has a PLC with address #1, etc. Once communication of the network of PLCs is established, each PLC senses control and position inputs from each other. Be aware that pairs are designated as post #1&2, post #3&4, post #5&6, and post #7&8, regardless of where they are physically placed in the system.

The height of each carriage above floor level is measured by string potentiometers (see next section) and compared to the other carriages by the PLC network. During raising, if any one carriage position is more than 1" higher than the lowest carriage, the higher (fastest) one slows down or stops to allow the lowest (slowest) one to catch up. During lowering, if any one carriage position is more than 1" lower than the highest carriage, the lower one slows down or stops to allow the highest one to catch up. This is all done by shifting motor contactors and lowering solenoid valve.

When lifting in Pair or Single mode, counting is not done, resulting in the PLC's seeing a "synchronized" state after this adjustment is made. There are limits on how far the lift will allow a Single post to raise/lower, and how far a Pair of posts can raise/lower relative to the rest of the system.

If you turn off the unit or press the Emergency Stop button, the computer position for each column is still retained and the columns will still maintain synchronized relative positions.

FUNCTION OF STRING POTENTIOMETER (String-Pot)

There is a string potentiometer (string-pot) mounted on the top of each column, and connected to each carriage, which senses the movement of the carriage. The string-pot sends an absolute analog (4-20mA) signal to the PLC as the string is pulled in and out of the sensor. This signal is absolute, which means that the lift will always know the height of the lift, even when powered off and on again. This signal is directly translated into height position and can be witnessed by viewing the Post Height Screen, F2. If raising or lowering is not possible, manually pulling the string-pot cable, while the unit is powered and pressing F2, will enable you to see the height changes.

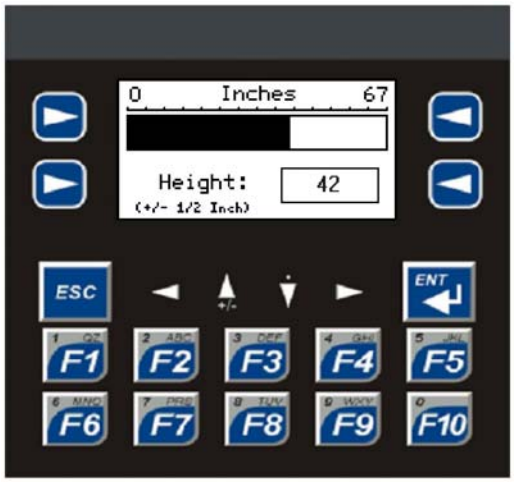
FUNCTION MENUS

The control screen has 10 function keys that will display various menus. They are as follows:

F1: Post ID and Active Posts Display

This screen will display the Post ID and all the active posts of the system it is connected to.

i.e. The display to the left shows post #2 connected in a 4-post system manner with posts #1, 2, 3, & 4.



F2: Post Height Display

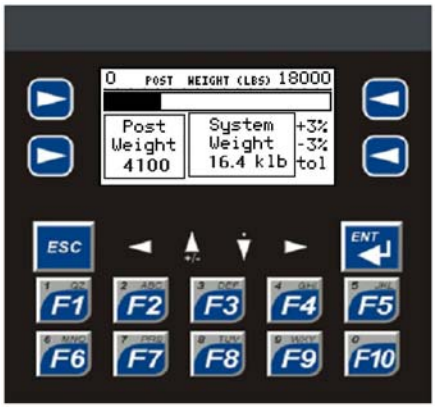
This screen will display the current post height in inches.

i.e. The display to the left shows the post at a height of 42 inches. (Note the tolerance of +/- ½ inch)

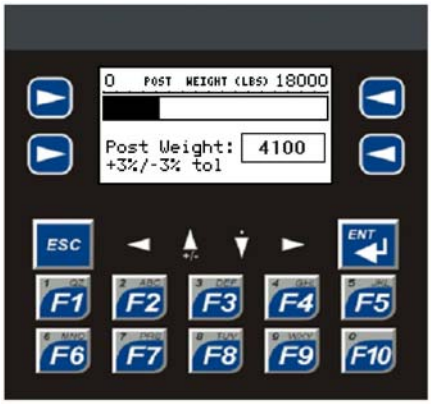
F3: Weight Display
This screen will display 1 of 3 screens, depending if the lift has the hydraulic pressure sensing option present. If all the posts in the system have the pressure sense option, the screen (A) will display showing the weight on the post and the total weight of the system. If only the present column has the pressure sense option, then screen (B) will display, showing only the post weight. If you are at a column that does not have a pressure sense option, then screen (C) will display. (Note the tolerance of +/- 3% in weights shown)

Refer to F9 for factory settings enabling and disabling the pressure sense option in each post.

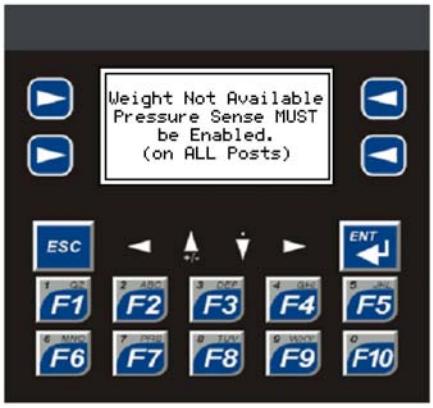
A

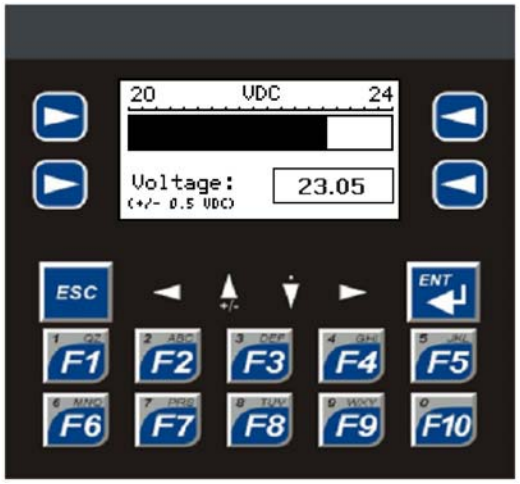


B



C



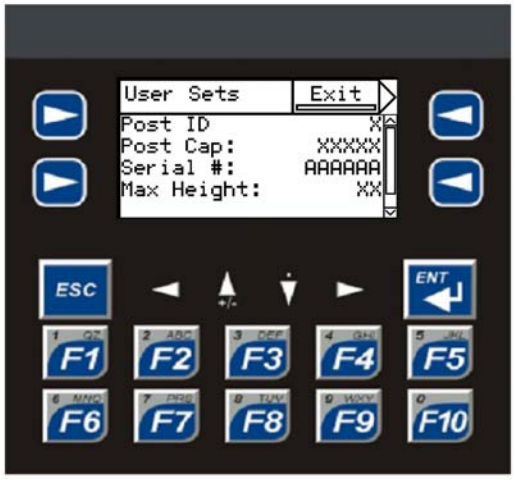


F4: Voltage Display
This screen will display the current voltage (VDC) of the battery system.

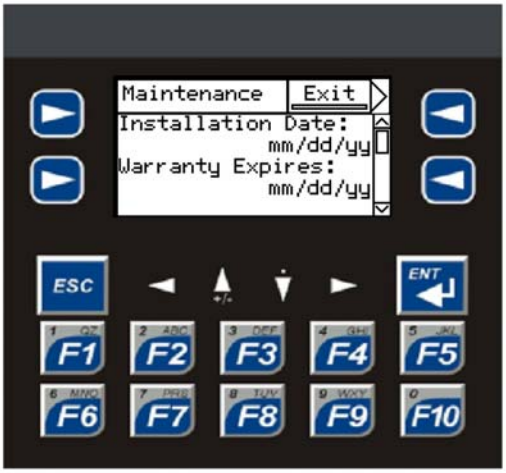
i.e. The display to the left shows the post at 23.05 VDC.
(Note the tolerance of +/- 0.5 VDC)

F5: User Settings Display

This screen displays general user settings of the lift. Pressing enter and the up or down arrow keys will scroll through this menu. Press Escape and the Exit Key to Exit Menu. Item shown in this menu are as follows:

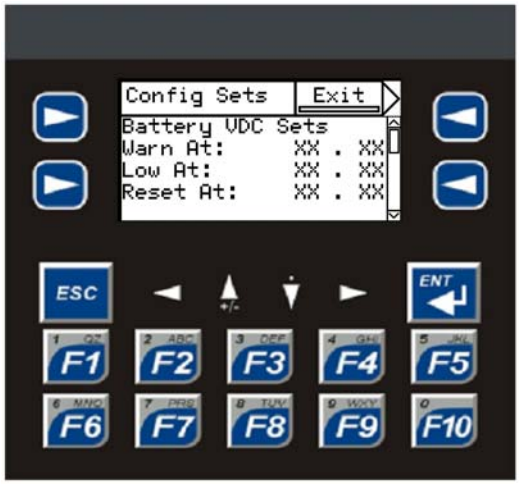


Post ID
Post Capacity
Serial Number
Maximum Height Limit
Warranty Expiration Date
Lifting Cycles Used



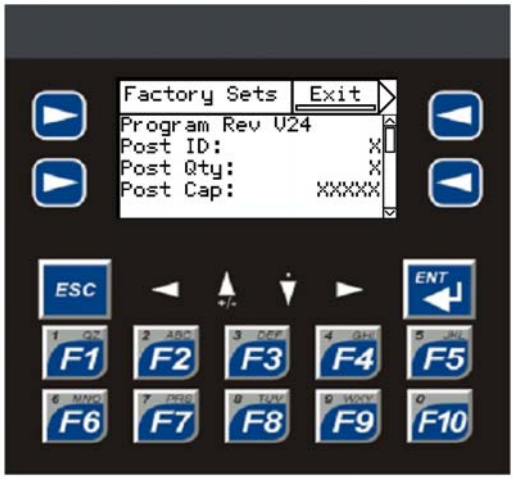
F7: Maintenance/Service Display
(Distributor or Factory Password Protected)

This screen displays general service and inspection information and service contact information. Distributor or Maintenance personell password required. (See F10).



F8: Configuration Settings (Factory Password Protected)

This screen displays configuration settings for the battery voltage monitoring, string-pot height sensor, and the pressure sensor. This is only accessible with the factory password (See F10).

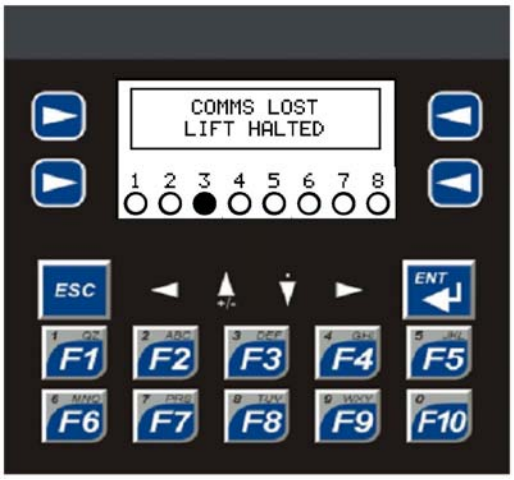


F9: Factory Settings (Factory Password Protected)
This screen displays factory settings. This is only accessible with the factory password (See F10).

F10: Password
This screen allows entry of the password which will give access to the PLC configuration settings and screens F9 and F10. Enter either the Distributor Password to give limited access to F7 screen, or the Factory Password to give access to all password protected screens.

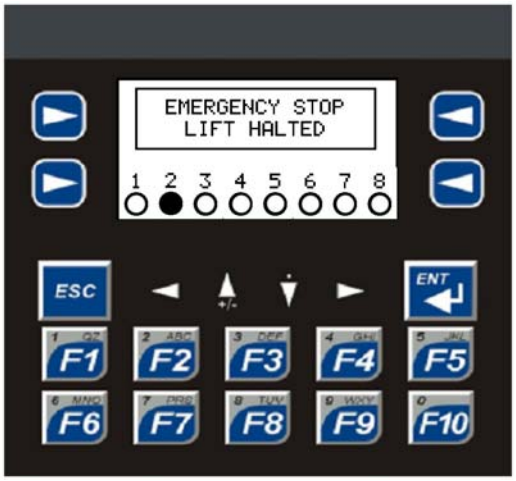
ERROR MESSAGES:
The following are a list of error messages that may display if certain situations arise.

Post Count Error:
This screen appears if the user says “NO” to the initial Active Posts response screen.
(See System Activation above)



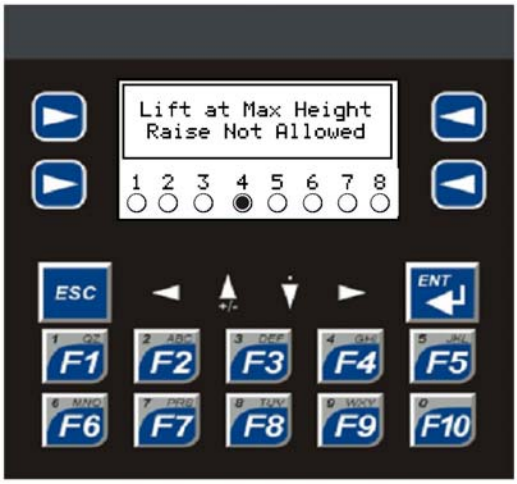
Comms Lost Error:
This screen appears if any column in the system is lost after it was previously present. This could be due to a column being turned off or if the communications to the post are not connected. The post in which communications is lost will be identified on the screen. All controls will be locked-out until this is remedied.

i.e. The display to the left shows loss of communications to post 3.



E-Stop Error:
If any post in the system has an Emergency Stop button pushed, this screen will appear showing which post was stopped. All controls will be locked-out until this is remedied.

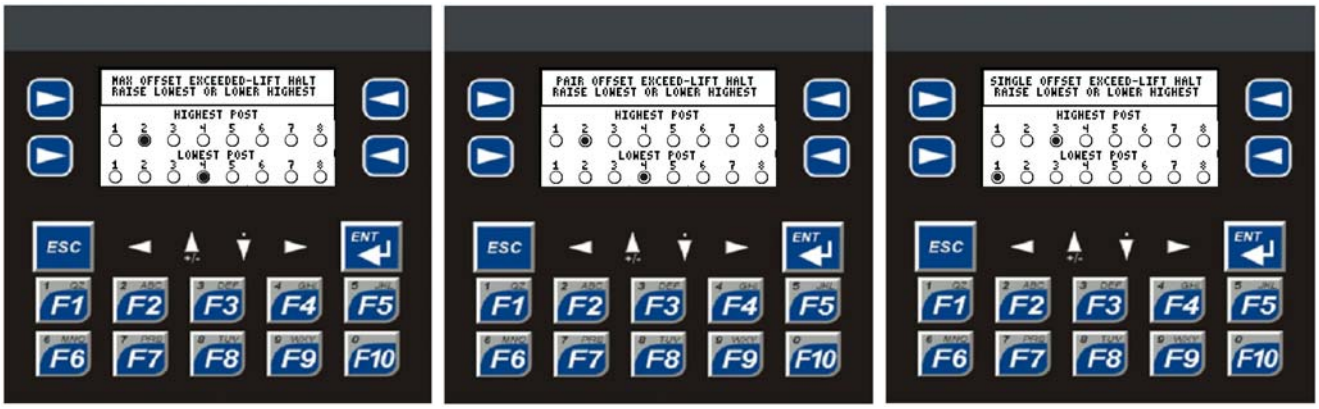
i.e. The display to the left shows the emergency stop button pushed on post 2.

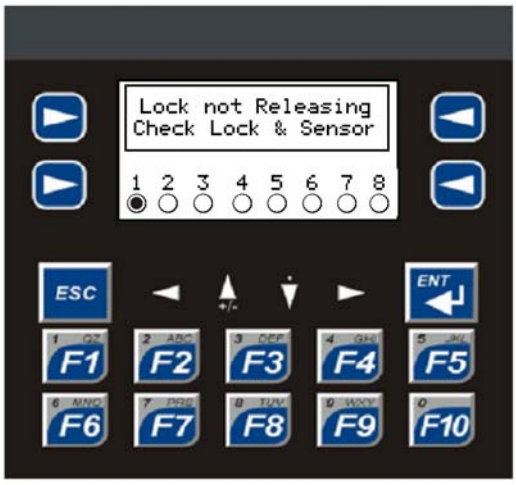


Lift at Max Height Error:
Indicates that a post has raised to the maximum height setting (set in the factory setting menu). The post that has reached this height will be identified. Raising and parking are **not** allowed in this situation, only lowering. (Note that the max height setting is adjustable for buildings with low clearance, etc..)

i.e. The display to the left shows that post 4 has reached max height.

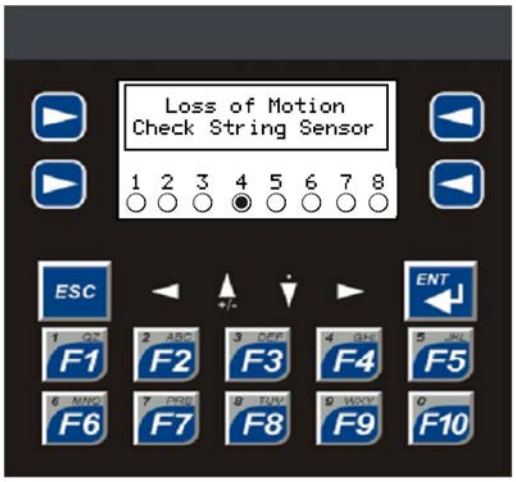
Maximum Offset Error:
There are limits on how far any post can be out of level from any other post, even when using Single and Pair overrides. If any post reaches its limits, one of the following screens will be displayed (depending on if the unit is being used in All, Pair, or Single). The highest and lowest posts will be identified. Raising is only allowed on the lowest post, Lowering only allowed on the Highest post. These offsets are normally outside the bounds of normal usage and prevent extreme out of level conditions.





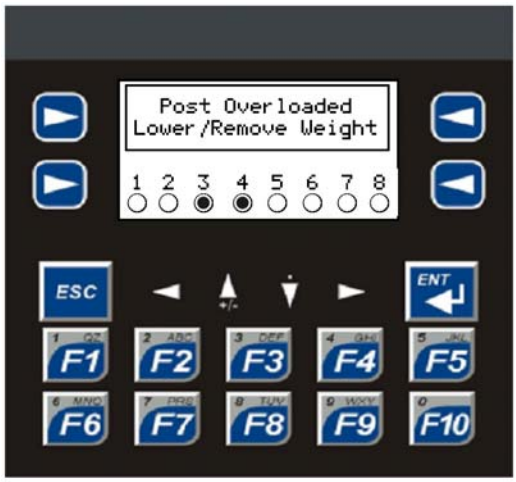
Lock Not Releasing Error:
This screen will only occur during Lowering of the lift. This screen indicates that one of the locks is not released, and it will prevent the lift from lowering. This may be due to a lock on the identified post from being mechanically parked, the solenoid not pulling the lock back, or the sensor not "seeing" the lock pulled back (sensor may need to be adjusted). The post that causes this error will be identified.

i.e. The display to the left shows that post 1 lock is not released.



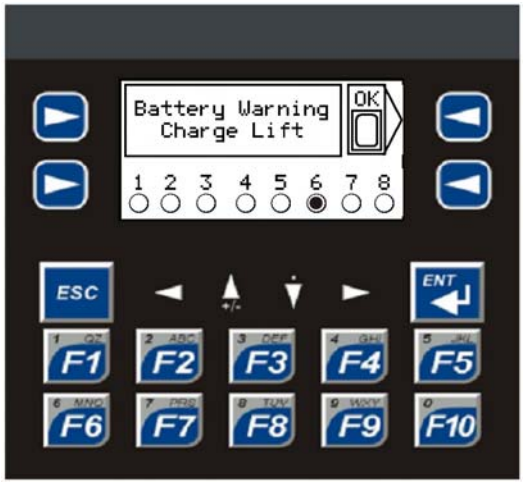
Loss of Motion Error:
This screen will occur if any post is not sensing motion when a raise or lowering command is present. This may occur if a post string-pot is disconnected, malfunctioning, or cable is broken. This also may occur if the lift is lowering onto an obstruction to prevent its motion. Press Exit key at post this occurs at to remove message. (Note: If message remains, then the string-pot is disconnected and needs to be repaired)

i.e. The display to the left shows that post 4 experienced a loss of motion while raising or lowering.



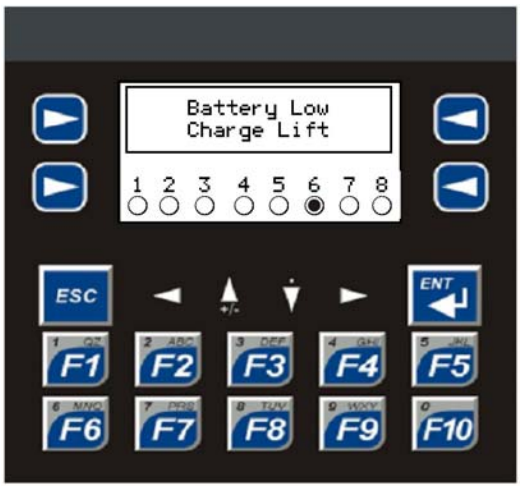
Post Overload Error: (Optional)
This screen will appear if any post has a weight on it that exceeds the capacity of the post. Post capacities are set in the factory setting menu. Raising and parking are not allowed in this situation, only lowering. (This error will only be present if the lift has the pressure sensing option.)

i.e. The display to the left shows that post 3 & 4 are overloaded.



Battery Warning:
This indicates that one of the post's batteries are low on charge and need to be recharged. (Also, refer to battery meter above control screen.) Pressing the "OK" button will allow lift function, but only for a few cycles until the "Battery Low" error occurs (see below).

i.e. The display to the left warns that post 6 battery is low.



Battery Low Error:
This indicates that one of the post's batteries is too low on charge and needs to be recharged. The lift will **not** function until this post is fully recharged.

i.e. The display to the left shows that post 6 battery is low and lift will **not** function until post 6 is fully recharged.

TROUBLE SHOOTING

NOTICE: Read manual prior to trouble shooting. A good understanding of how this lift and its controls function will greatly help in understanding any problems that may occur.

START-UP:

Problem: Upon power up, screen does not illuminate (on any single column).

Solution1: Verify that power cables are unplugged from charger inlets on all posts. Post will not power up unless power is removed from charger.

Solution2: Check to see that battery cables are connected to batteries properly. Also verify 24 VDC at the control panel.

Solution3: PLC may have faulty screen. Consult Mohawk Service department.

Problem: All posts are not shown on activation screen.

Solution1: Verify that all posts in system are turned on to "Operate Lift".

Solution2: Check for proper communication cable and dummy plug connection of all posts. (See lift setup)

Solution3: Possible faulty communication cable or dummy plug. Consult Mohawk Service department.

Problem: Error Code present.

Solution: See Error Code Section in this manual.

DURING OPERATION:

Problem: Error Code present.

Solution: See Error Code Section in this manual.

Problem: There is more than 1-1/2" height difference between carriages.

Solution: This may be due to the fact that one column was operated on SINGLE before operating the unit in the ALL mode. This may also be due to operating in the PAIR mode before operating in ALL mode.

Problem: Lift jack not raising lift or lift jack not collapsing when loaded.

Solution1: Lift jack relief valve needs to be adjusted. Turn relief set screw clockwise to increase lifting ability of jack. Turn relief set screw counter-clockwise to reduce lifting ability of jack. See illustration in back of manual.

Solution2: Jack is low on oil. Add oil. (Dexron III AFT or equivalent)

Problem: Carriage is lowering on its own.

Solution1: Check that there are no oil leaks by checking around the column. If so, repair the leak condition.

Solution2: If Solution 1 does no produce results, check for leakage of cylinder piston seals. Remove black plastic vent tube from power unit reservoir tank port and see if any fluid is flowing out. If so, cylinder piston seals are leaking. Contact Mohawk's Service department.

Solution3: If Solution 2 does not produce results, the lowering valve(s), located on the power unit may have collected some dirt, preventing them from sealing properly. Make sure that the carriage is lowered to floor level in order that there is no pressure in the system. Disconnect the power so that no one can start the unit. You can now remove the lowering valve(s). Disconnect the electrical leads from the solenoid using a screwdriver to remove the screw holding the two mating connectors. Remove the lowering valve(s) from the power unit and check to see that there is no foreign material in the valve ends, which prevent the balls from sealing. Remove the foreign material. If you cannot find any problem, replacement of valve may be required. Contact Mohawk's Service department.

Solution4: If Solution 3 does not produce results, the power unit's main load holding check valve may have collected some dirt, preventing it from sealing properly. Make sure that the carriage is lowered to floor level in order that there is no pressure in the system. Disconnect the power so that no one can start the unit. You can now remove the check valve components and check to see if there is any foreign material in the valve cavity to prevent the ball from sealing. Remove the foreign material. If you cannot find any problem, re-seating of the valve, or replacement of valve may be required. Contact Mohawk's Service department.

MODEL:
SERIAL NUMBER:
DATE OF INSTALLATION:

SERVICE CHART

DATE	PART REPLACED / SERVICED	SERVICE COMPANY	SERVICED BY

MAINTENANCE CHART

DATE	MAINTENANCE PERFORMED	SERVICE COMPANY	SERVICED BY

MOHAWK

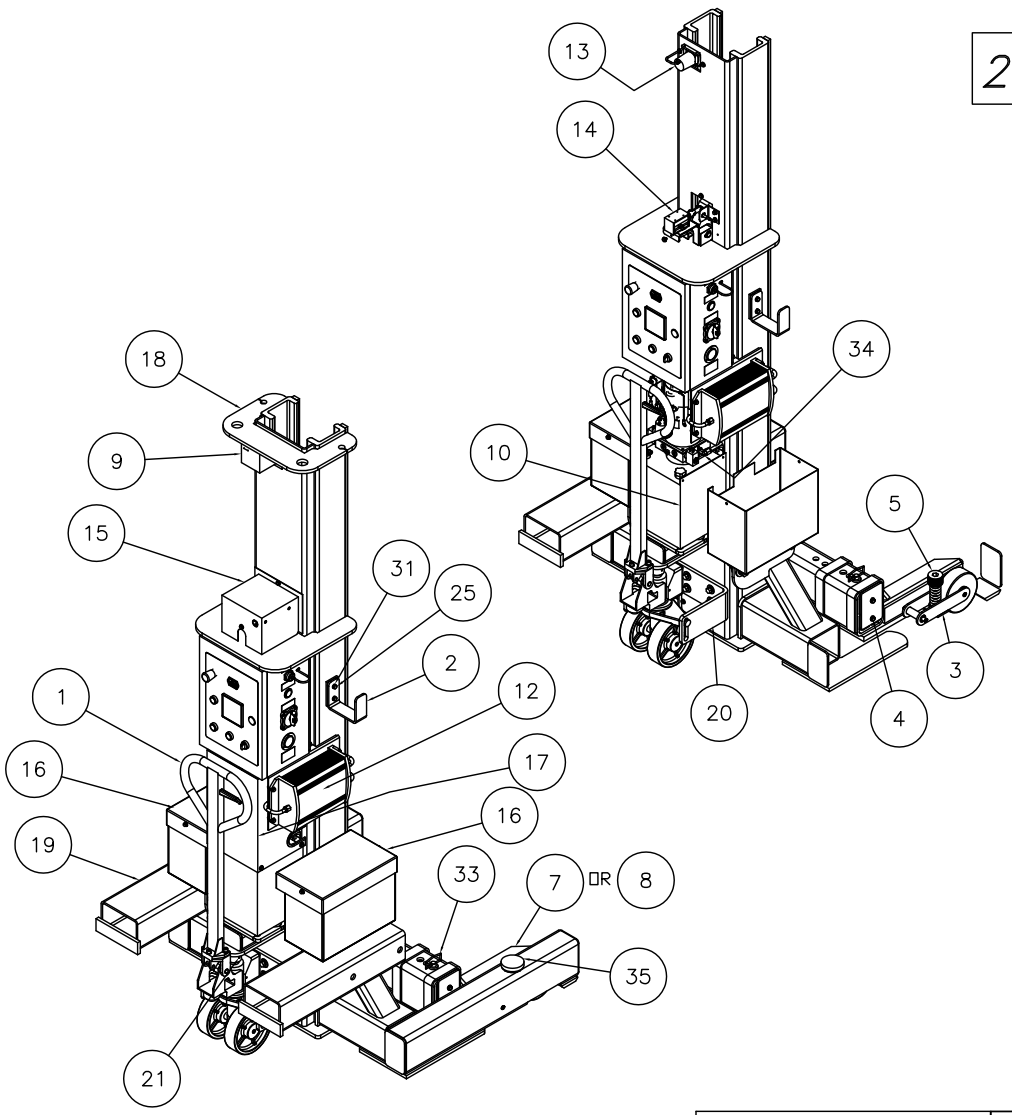
PARTS

MP-18-24VDC-SERIES

ELECTRIC/HYDRAULIC
PORTABLE LIFT

24 VDC W/15" FORKS

#	DESCRIPTION	DATE	APPROVED
A	ITEM 10 WAS MP-5400-A-003	07/15/2008	DM
B	REMOVED HOOK ITEM 2 FROM LEFT SIDE REMOVED ASSOCIATED HARDWARE ITEMS 25 & 31	06/08/2010	G. GORE
C	ITEM 1 WAS MP-0400-A-003	07/21/2011	G.GORE
D	ITEM 12 WAS MP-5100-A-005	08/02/2011	G.GORE



23 26 28 (X2) 32 — ATTACH PACKING TUBES (TYP 4 PLACES)

22 29 31 — ATTACH PU ON POST SHELF (TYP 4 PLACES)

22 27 29 (X2) — FOR MOUNTING ELECTRICAL CONTROL BOX (TYP 4 PLACES)

6 36 37 38 (NOT SHOWN)

24 30 — AT ALL COVERS (TYP 6 PLACES)

25 31 — AT CABLE BRACKETS (TYP 4 PLACES)

	ITEM	NAME	DESCRIPTION	QTY	MATERIAL	VENDOR	NOTE	MASS	PRICE
	38	MP-5400-A-011	Tag & Decal Location, MP-24VDC	1				0.000	
	37	MP-5100-A-011	Cable Assy, 40" Lg, Black	1				1.000	
	36	MP-5100-A-010	Cable Assy, 36" Lg, Red	1				1.000	
	35	601-460-005	Cap, Plastic, Red, 3" Dia x 1/2 Thk	2		Caplugs #EC-48		0.020	
	34	601-420-017	Elbow, 90 Deg, #6 ORB to #6 JIC	1		Aeroquip #2062-6-6S		0.100	
	33	600-900-006	Hitch Pin, 3/4 Dia	2		McMaster #98497A664		0.750	
	32	600-720-008	Washer, Lock, 3/4	4				0.040	
	31	600-720-002	Washer, Lock, 5/16	6				0.004	
B	30	600-710-004	Washer, Flat, 1/4	6				0.005	
	29	600-710-003	Washer, Flat, 5/16	12				0.005	
	28	600-710-001	Washer, Flat, 3/4	8				0.110	
	27	600-690-001	Nut, Nylon Lock, 5/16-18 NC	4				0.010	
	26	600-680-005	Nut, Plain, 3/4-16 NF	4				0.120	
	25	600-640-053	Bolt, Hex Head, 5/16-18 NC x 1/2 Lg (Gr 5)	2				0.020	
B	24	600-640-039	Bolt, Hex Head, 1/4-20 NC x 3/8 Lg (Gr 5)	6				0.010	
	23	600-640-003	Bolt, Hex Head, 3/4-16 NF x 2 1/2" (GR5)	4				0.500	
	22	600-640-001	Bolt, Hex Head, 5/16-18 NC x 1 1/4" lg (Gr 5)	8				0.040	
	21	600-630-003	Set Screw, 1/4-20 NC x 1/2 Lg	1				0.010	
	20	P-150-P-004	Access Hole Cover	1	600-030-008		10ga x 3 1/4" x 6"	0.730	
	19	MP-5400-W-001	Packing Tube Weldment (24V)	2				39.760	
	18	MP-5300-W-003	Leg Secondary Weldment, 24 VDC	1				747.000	
	17	MP-5300-A-002	PU Cover Assy (24 VDC)	1				8.000	
	16	MP-5300-A-001	Battery Box Assy	2				85.600	
	15	MP-5200-P-001	Lock Cover	1	600-030-014		16 Gauge	3.460	
	14	MP-5200-A-001	Lock Release Assy, 24 VDC	1				6.800	
	13	MP-5100-A-014	String Pot Assembly, ANALOG	1				0.700	
D	12	MP-5100-A-012	Charger Assembly	1				24.750	
	11	MP-5100-A-001	Master Box Assy	1					
A	10	MP-5400-A-014	Power Unit Assy, 24 VDC (8-2008)	1				75.000	
	9	MP-1100-P-003	Sensor Cover	1	600-030-014		16 Gauge	1.000	
	8	MP-1000-W-006	Fork Weldment, Right	1				62.300	
	7	MP-1000-W-005	Fork Weldment, Left	1				67.300	
	6	MP-0900-A-001	Cylinder Assembly	1				126.000	
	5	MP-0800-P-024	Threaded Spring Retainer	2	600-090-019		2" Dia x 2 1/2 Lg	1.170	
	4	MP-0700-A-001	Carriage Assembly	1				290.000	
	3	MP-0500-A-001	Floor Roller Assembly	2				7.840	
B	2	MP-0400-P-002	Cable Hook	1	600-010-027		1/4 x 2" (Flat) x 13" Long	1.850	
C	1	MP-0400-A-007	JACK ASSEMBLY	1					

Parts List

NOTICE OF CONFIDENTIAL INFORMATION

INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPERTY OF MOHAWK RESOURCES LTD.. WHERE DRAWING IS FURNISHED TO OTHERS IT SHALL BE USED SOLELY FOR PURPOSES OF INSPECTION, INSTALLATION, OR MAINTENANCE. THE INFORMATION SHALL NOT BE USED OR DISCLOSED BY THE RECIPIENT FOR ANY OTHER PURPOSES WHATSOEVER.

NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL:
.0XX ± .030
.0XXX ± .005

FILE NAME MP-5400-A-001.dwg

MP-5400-

NEXT ASSEMBLY

SCALE 1'0"=1'0" | DRAWN rwv7089 | CHECKED | APPROVED | DATE 4/07 | WEIGHT 1700 LB. | FROM N/A

MOHAWK RESOURCES LTD.

TITLE MP-24VDC-SERIES Master Post Assembly

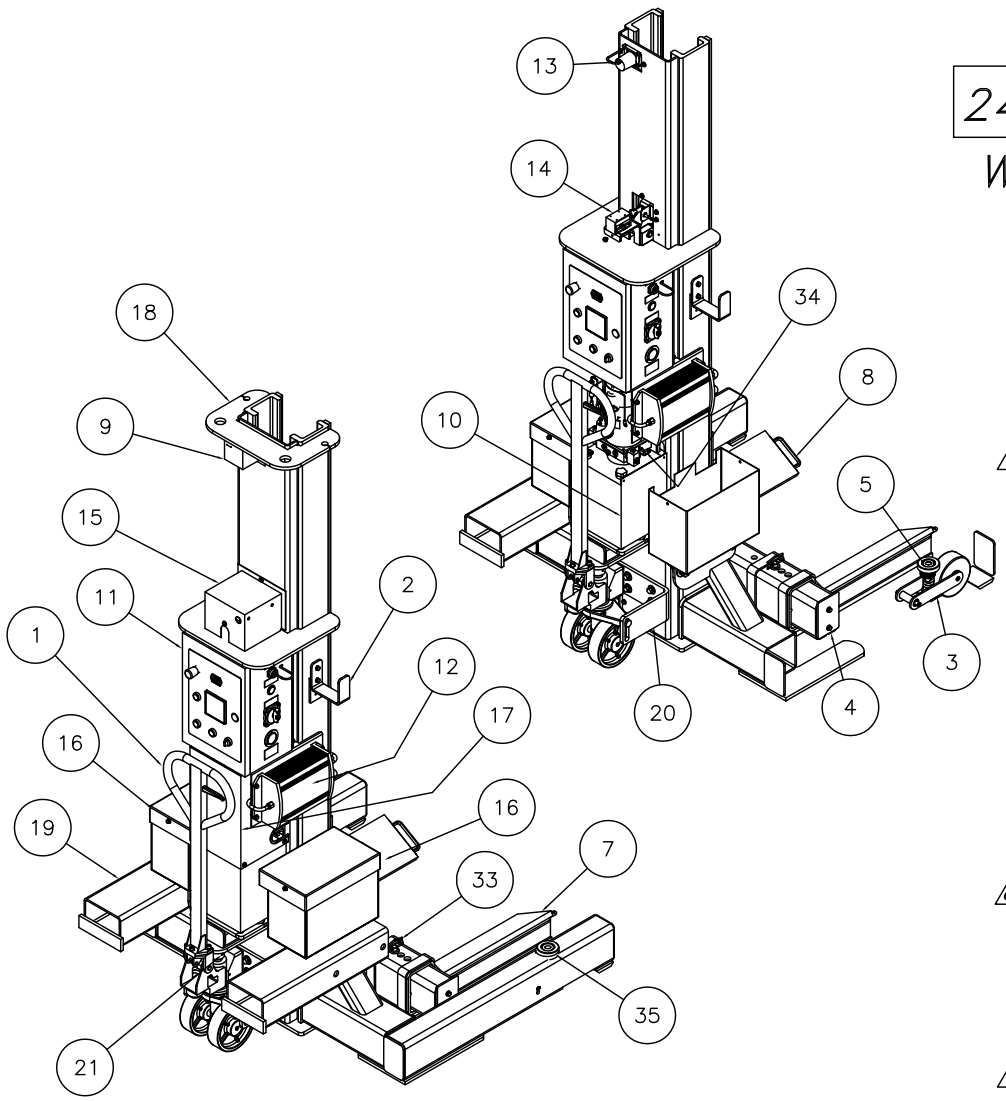
DRAWING NUMBER MP-5400-A-001 D

D-SIZE

#	DESCRIPTION	DATE	APPROVED
A	ITEM 38 (MP-5400-A-017) ADDED	03/24/2010	dak0879
B	ITEM 1 WAS MP-0400-A-003	07/21/2011	G.GORE
C	Item 12 Was MP-5100-A-005	08/02/2011	G.GORE

24 VDC W/22" FORKS

WIDER



23 26 28 (X2) 32 — ATTACH PACKING TUBES (TYP 4 PLACES)

22 29 31 — ATTACH PU ON POST SHELF (TYP 4 PLACES)

22 27 29 (X2) — FOR MOUNTING ELECTRICAL CONTROL BOX (TYP 4 PLACES)

6 36 37 38 — (NOT SHOWN)

24 30 — AT ALL COVERS (TYP 6 PLACES)

25 31 — AT CABLE BRACKETS (TYP 4 PLACES)

ITEM	NAME	DESCRIPTION	QTY	MATERIAL	VENDOR	NOTE	MASS	PRICE
A	MP-5400-A-017	Tag & Decal Location	1				0.000	
	MP-5100-A-011	Cable Assy, 40" Lg, Black	1				1.000	
	MP-5100-A-010	Cable Assy, 36" Lg, Red	1				1.000	
	601-460-005	Cap, Plastic, Red, 3" Dia x 1/2 Thk	2		Caplugs #EC-48		0.020	
	601-420-017	Elbow, 90 Deg, #6 ORB to #6 JIC	1		Aeroquip #2062-6-6S		0.100	
	600-900-006	Hitch Pin, 3/4 Dia	2		McMaster #98497A664		0.750	
	600-720-008	Washer, Lock, 3/4	4				0.040	
	600-720-002	Washer, Lock, 5/16	8				0.004	
	600-710-004	Washer, Flat, 1/4	6				0.005	
	600-710-003	Washer, Flat, 5/16	12				0.005	
	600-710-001	Washer, Flat, 3/4	8				0.110	
	600-690-001	Nut, Nylon Lock, 5/16-18 NC	4				0.010	
	600-680-005	Nut, Plain, 3/4-16 NF	4				0.120	
	600-640-053	Bolt, Hex Head, 5/16-18 NC x 1/2 Lg (Gr 5)	4				0.020	
	600-640-039	Bolt, Hex Head, 1/4-20 NC x 3/8 Lg (Gr 5)	6				0.010	
	600-640-003	Bolt, Hex Head, 3/4-16 NF x 2 1/2" (GR5)	4				0.500	
	600-640-001	Bolt, Hex Head, 5/16-18 NC x 1 1/4" lg (Gr 5)	8				0.040	
	600-630-003	Set Screw, 1/4-20 NC x 1/2 Lg	1				0.010	
	P-150-P-004	Access Hole Cover	1	600-030-008		10ga x 3 1/4" x 6"	0.730	
	MP-5400-W-001	Packing Tube Weldment (24V)	2				39.760	
	MP-5300-W-006	Leg Secondary Weldment, 24 VDC (22" Forks)WIDER	1				746.600	
	MP-5300-A-002	PU Cover Assy (24 VDC)	1				8.000	
	MP-5300-A-001	Battery Box Assy	2				85.600	
	MP-5200-P-001	Lock Cover	1	600-030-014		16 Gauge	3.460	
	MP-5200-A-001	Lock Release Assy, 24 VDC	1				6.800	
	MP-5100-A-014	String Pot Assembly, ANALOG	1				0.700	
C	MP-5100-A-012	Charger Assembly	1				24.750	
	MP-5100-A-003	Master Enclosure Assembly	1				26.500	
	MP-5400-A-014	Power Unit Assy, 24 VDC (8-2008)	1				75.000	
	MP-1100-P-003	Sensor Cover	1	600-030-014		16 Gauge	1.000	
	MP-1500-W-004	Fork Weldment, Right, LONGER (22")	1				115.800	
	MP-1500-W-003	Fork Weldment, Left, LONGER(22")	1				115.830	
	MP-0900-A-001	Cylinder Assembly	1				126.000	
	MP-0800-P-024	Threaded Spring Retainer	2	600-090-019		2" Dia x 2 1/2 Lg	1.170	
	MP-1900-A-001	Carriage Assembly (WIDER)	1				300.000	
	MP-0500-A-001	Floor Roller Assembly	2				7.840	
	MP-0400-P-002	Cable Hook	2	600-010-027		1/4 x 2" (Flat) x 13" Long	1.850	
B	MP-0400-A-007	JACK ASSEMBLY	1					

Parts List

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NOTES:
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2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

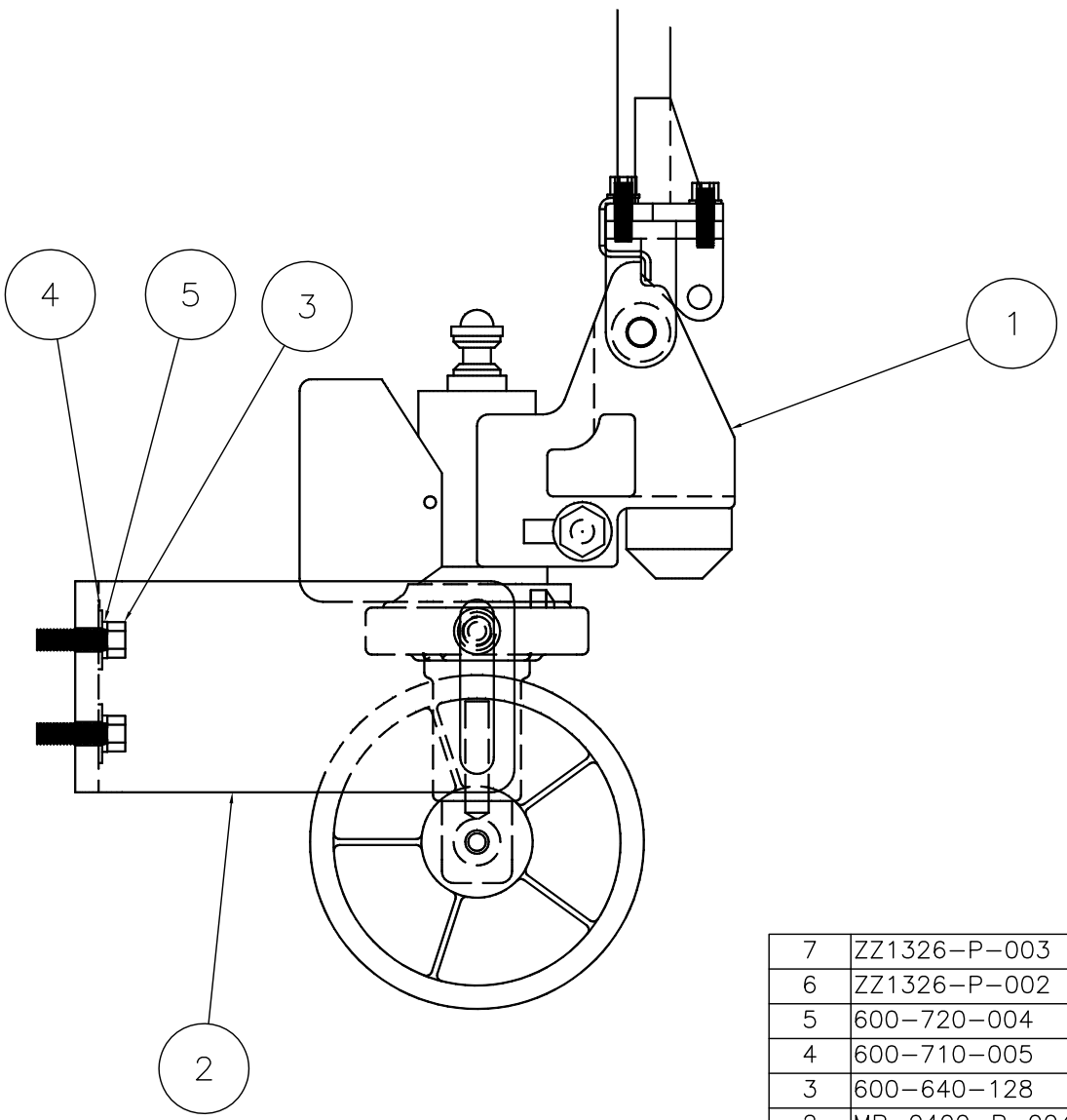
FILE NAME: MP-5400-A-015.dwg

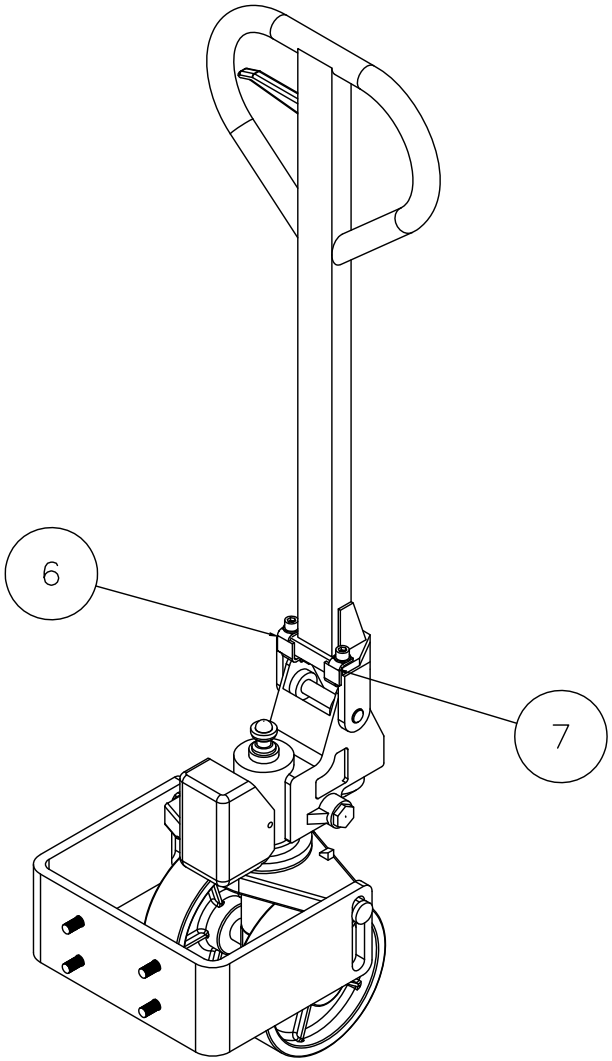
MP-5400-

NEXT ASSEMBLY

SCALE: 1/8	DRAWN: dak0879	MOHAWK RESOURCES LTD.	
	CHECKED	APPROVED	TITLE: MP-24VDC-SERIES (WIDER) Master Post Assy (22" Forks)
DATE: 8/08	WEIGHT: 1837 LB.	FROM: N/A	DRAWING NUMBER: MP-5400-A-015 C

D-SIZE





ITEM	NAME	DESCRIPTION	QTY
7	ZZ1326-P-003	Right Jack Stop Bracket	1
6	ZZ1326-P-002	Left Jack Stop Bracket	1
5	600-720-004	LOCK WASHER, 7/16	4
4	600-710-005	Washer, Flat, 7/16	4
3	600-640-128	Bolt, Hex Head, 7/16-14 NC x 1 1/2 (GR8)	4
2	MP-0400-P-004	Jack Lower Support Bracket (HC Jack)	1
1	601-500-011	JACK DOLLEY	1

C-SIZE

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TOLERANCES:
ANGULAR ± 1 °
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP-0400-A-007*

NEXT ASSEMBLY

SCALE *1/2*
DRAWN *G.GORE*
CHECKED
APPROVED
DATE *07/11*
WEIGHT *47.5* LB.

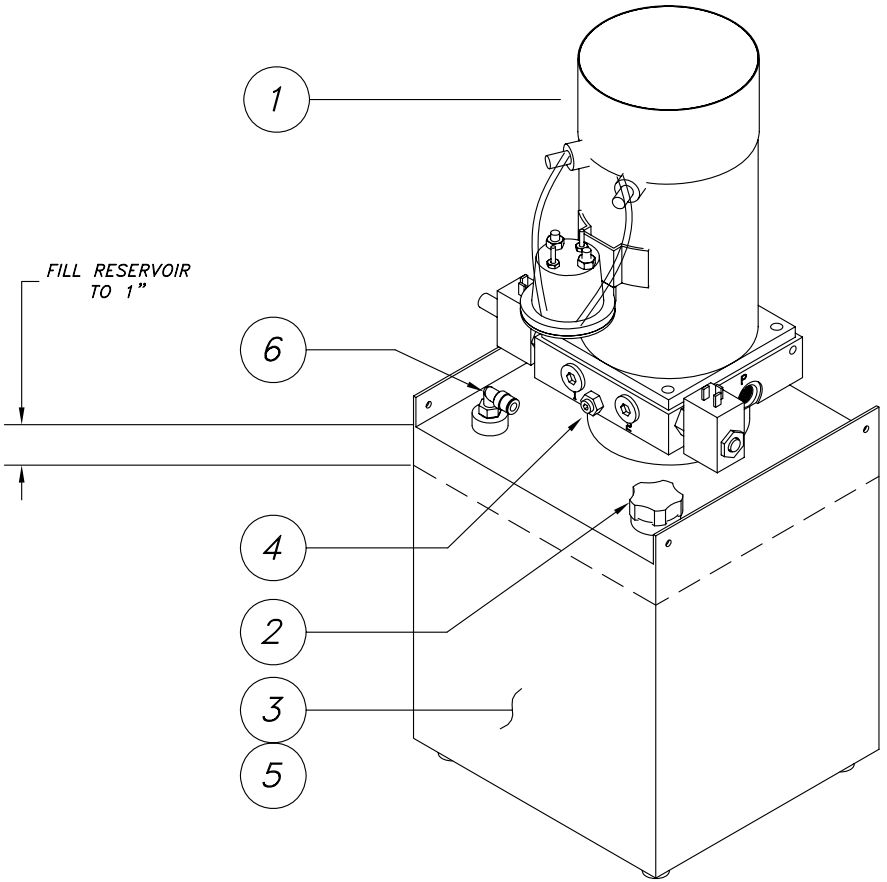
MOHAWK RESOURCES LTD.

TITLE *Mobile Post Lift Jack Assembly*

FROM

DRAWING NUMBER *MP-0400-A-007*

#	DESCRIPTION	DATE	APPROVED
A	ITEM 1 WAS 601-300-094	08/15/2008	dak0879



ITEM	NAME	DESCRIPTION	QTY
6	601-520-003	90 Deg Swivel, 1/4 NPT to 1/4 Tube	1
5	601-610-007	Hydraulic Fluid Additive 0.02 Bottles	1
4	601-610-006	Tamper-Proof Sealant 0.05 Tubes	1
3	601-610-001	Hydraulic Fluid, 3.25 Gallons	1
2	601-310-005	Breather Cap	1
1	601-300-095	Power Unit, 24 VDC Mobile Post	1

Parts List

C-SIZE

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NOTES:
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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME MP-5400-A-014

MP-5400-A-001 & 004

NEXT ASSEMBLY

SCALE 3/8 | DRAWN DM | CHECKED | APPROVED | DATE 7/08 | WEIGHT 75 LB.

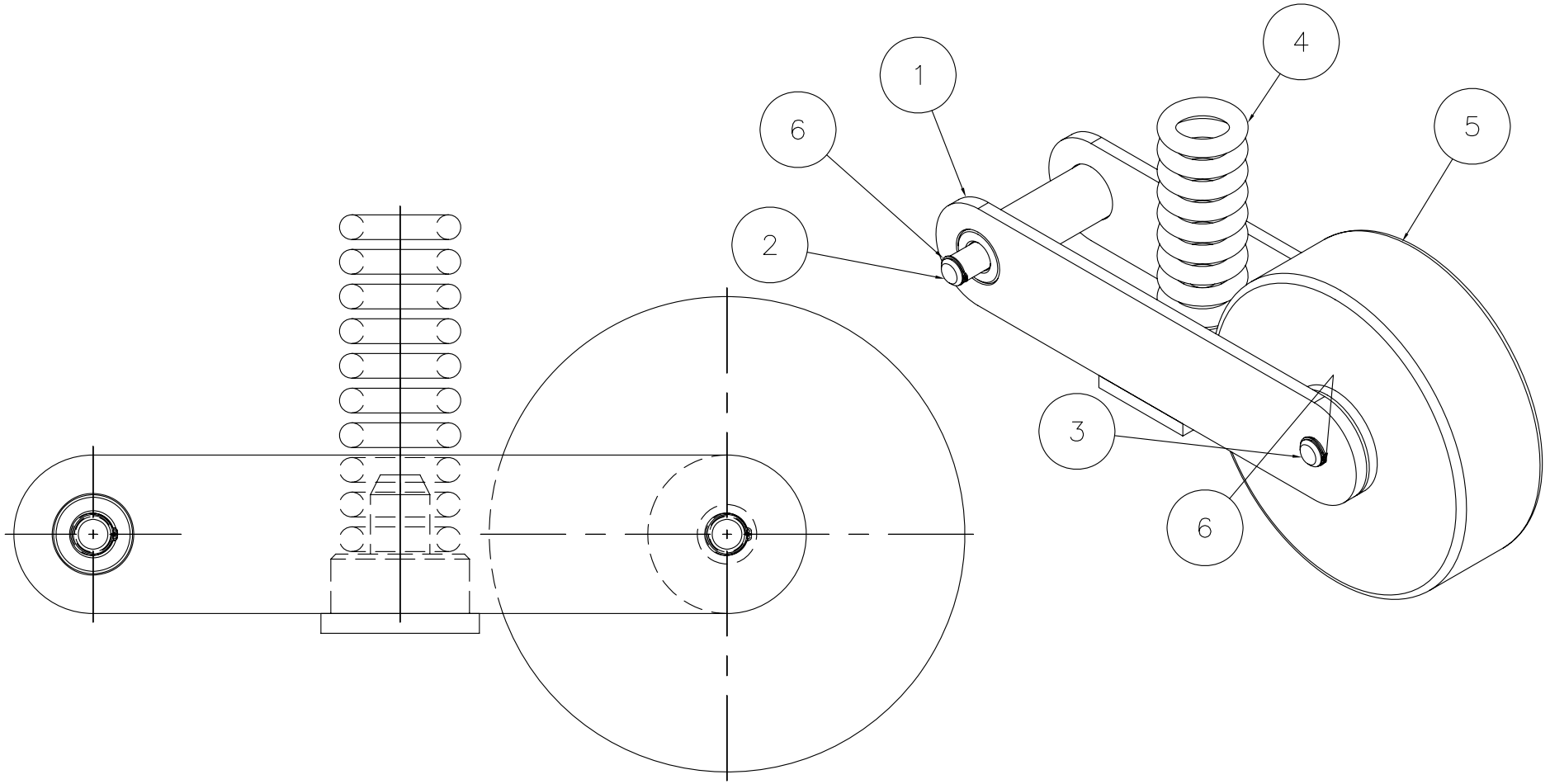
MOHAWK RESOURCES LTD.

TITLE Mobile Post (8-2008)
P.U. Assy, 24 VDC

FROM

DRAWING NUMBER MP-5400-A-014 A

#	DESCRIPTION	DATE	APPROVED
A	1) VIEWS UPDATED	08/30/2005	dak0879
	2) WT WAS 7.92		



ITEM	NAME	DESCRIPTION	QTY
6	600-870-003	Snap Ring, External, 1/2	4
5	600-920-018	Wheel, 6" Dia x 1/2 ID x 2 3/16 Hub	1
4	600-840-025	Spring, 4.25 Lg x 1.531 OD x .907 ID	1
3	MP-0500-P-006	Roller Axle Pin	1
2	MP-0500-P-005	Pivot Pin	1
1	MP-0500-W-001	Roller Pivot Weldment	1

Parts List

C-SIZE

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP-0500-A-001.dwg*

MP-

NEXT ASSEMBLY

SCALE *1'0"=1'0"*
DRAWN *rwv7089*
CHECKED
APPROVED
DATE *07/26/2004*
WEIGHT *7.84* LB.

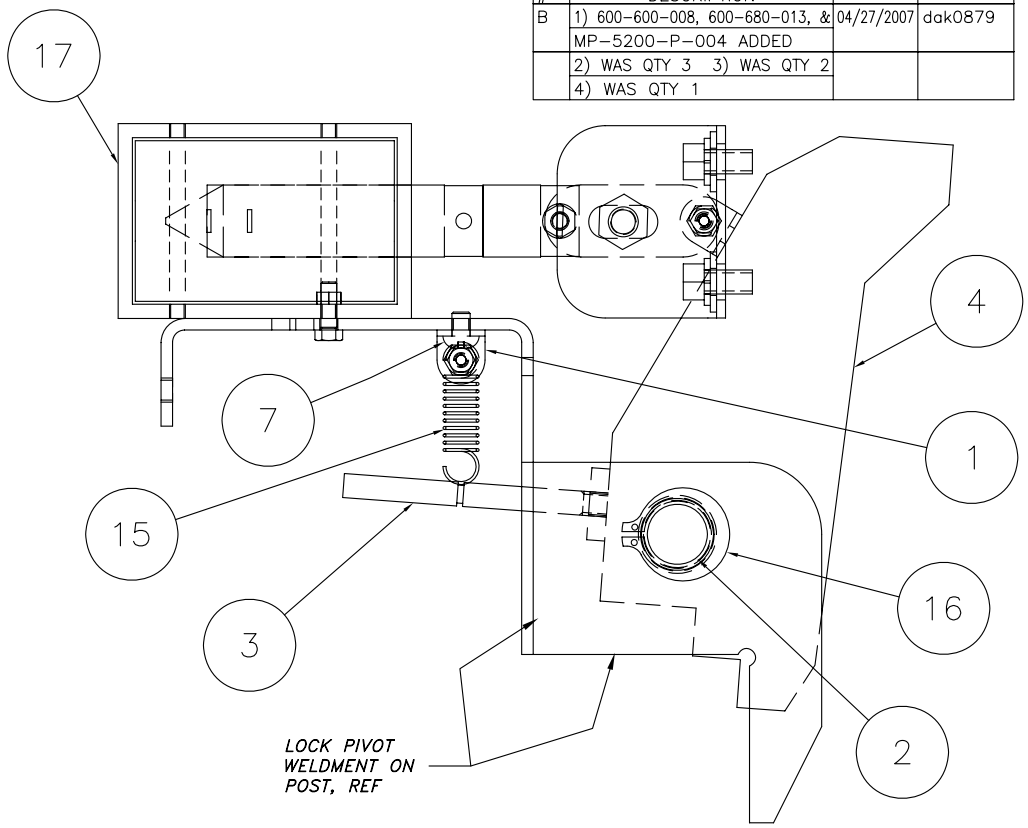
MOHAWK RESOURCES LTD.

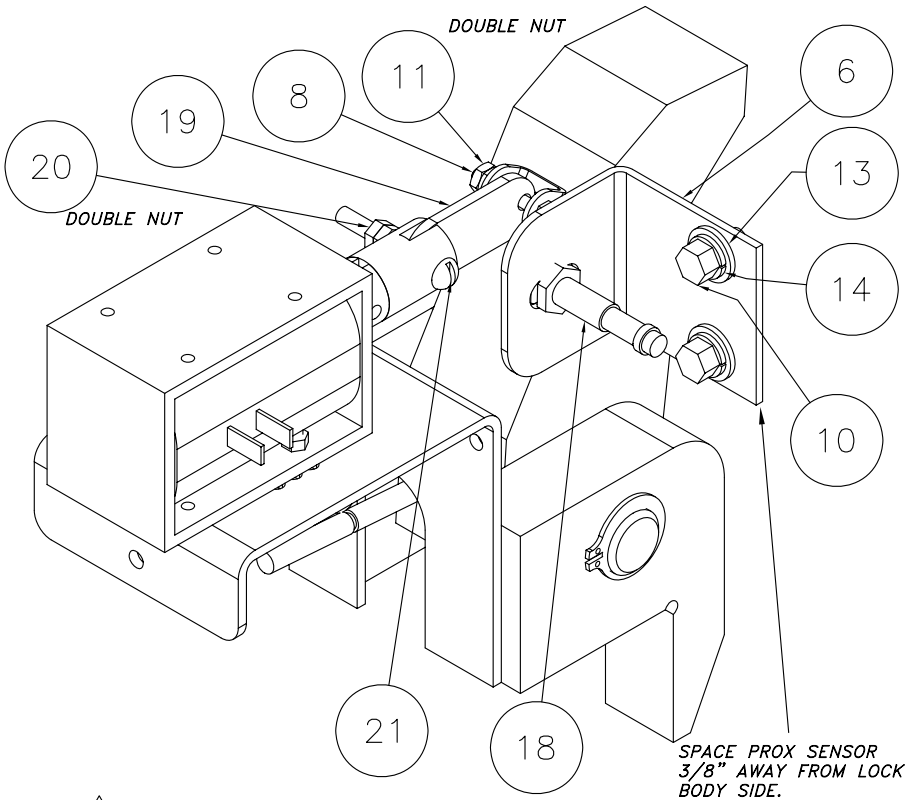
TITLE *Mobile Post Lift Floor Roller Assembly*

FROM *N/A*
DRAWING NUMBER *MP-0500-A-001*
A

#	DESCRIPTION	DATE	APPROVED
B	1) 600-600-008, 600-680-013, & MP-5200-P-004 ADDED	04/27/2007	dak0879
	2) WAS QTY 3 3) WAS QTY 2 4) WAS QTY 1		

#	DESCRIPTION	DATE	APPROVED
A	ITEM 18 WAS 601-160-200	03/26/2007	dak0879





ITEM	NAME	DESCRIPTION	QTY
21	600-600-008	Screw, Slotted Round Head, #10-32 NF x 1 1/2	1
20	600-680-013	Nut, Plain, #10-32 NF	2
19	MP-5200-P-004	Lock Flat	1
18	601-160-213	Inductive Proximity Switch, 10-30 VDC	1
17	601-160-199	Lock Solenoid, 24 VDC, 1" Stroke, 100% Duty	1
16	600-870-005	Snap Ring, 0.693 ID	2
15	600-840-026	Spring, Extension, 1" Lg	1
14	600-720-007	Washer, Lock, 1/4	2
13	600-710-004	Washer, Flat, 1/4	2
12	600-680-028	Nut, Plain, #8-32 NC	2
11	600-680-023	Plain Nut, #6-32NC	4
10	600-640-042	Bolt, Hex Head, 1/4-20 NC x 1/2 (GR5)	2
9	600-600-029	Hex Machine Screw, #8-32NC x 1/2 Lg	2
8	600-600-019	Hex Head Machine Screw, #6-32NC x 1" Long	2
7	600-600-013	Screw, #10-32 x 1/4", Slotted Round Head, Machine	1
6	MP-5200-P-003	Prox Mounting Bracket	1
5	MP-5200-P-002	Lock Solenoid Mounting Bracket	1
4	MP-0600-W-002	Lock Weldment	1
3	MP-0600-P-006	Lock Release Handle	1
2	MP-0600-P-004	Lock Pivot Pin	1
1	MP-0600-P-003	Spring Clip	1

Parts List

C-SIZE

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME MP-5200-A-001.dwg

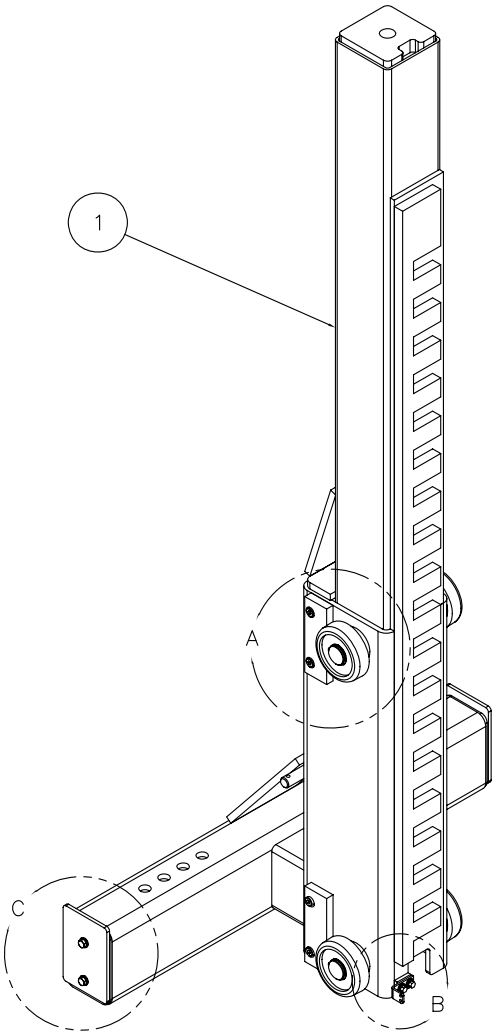
MP-

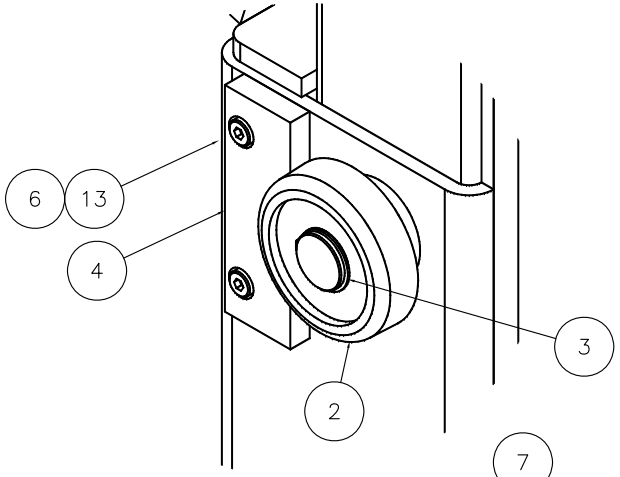
NEXT ASSEMBLY

SCALE 1'0"=1'0"	DRAWN rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE MP-24VDC-SERIES Lock Assembly, 24 VDC	
DATE 12/8/06	WEIGHT 6.8 LB.	FROM n/a	DRAWING NUMBER MP-5200-A-001 B

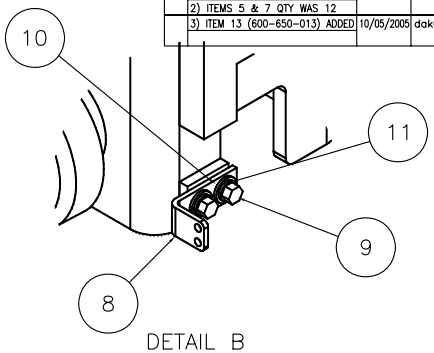
#	DESCRIPTION	DATE	APPROVED
D	1) ITEM 1 VIEW UPDATED	10/26/2005	dak0879
	2) ITEM 12 VIEW UPDATED		

#	DESCRIPTION	DATE	APPROVED
A	1)ITEM 4 THICKN'SS WAS 9/16	06/28/2005	dak0879
	2)ITEMS 5, 6, 7, 9, 10, 11 QTY WAS 1 (TYPO ERROR)	06/28/2005	dak0879
	3)ITEM 5 WAS 600-640-001		
B	View of Item 1 Changed	08/25/2005	rwv7089
C	1) ITEM 2 WAS 600-860-018	10/05/2005	dak0879
	2) ITEMS 5 & 7 QTY WAS 12		
	3) ITEM 13 (600-650-013) ADDED	10/05/2005	dak0879

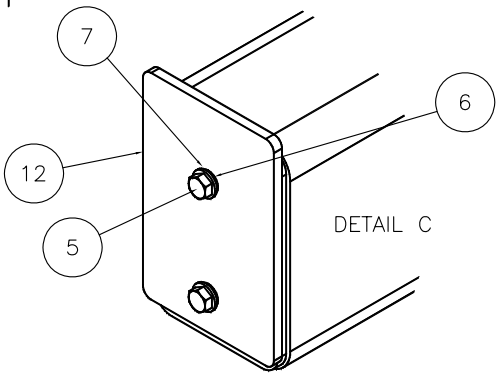




DETAIL A



DETAIL B



DETAIL C

ITEM	NAME	DESCRIPTION	QTY
13	600-650-013	Socket Cap Screw, 5/16-18 NC x 3/4 Lg	8
12	MP-0700-P-016	Tube End Stop	2
11	600-720-007	Washer, Lock, 1/4	2
10	600-710-004	Washer, Flat, 1/4	2
9	600-640-042	Bolt, Hex Head, 1/4-20 NC x 1/2 (GR5)	2
8	MP-0700-P-015	Cable Support Angle	1
7	600-710-003	Washer, Flat, 5/16	4
6	600-720-002	Washer, Lock, 5/16	12
5	600-640-017	Bolt, Hex Head, 5/16-18 NC x 1" lg (Gr 5)	4
4	MP-0700-P-012	Slide Block, UHMW	4
3	600-870-001	Snap Ring, 1 3/8 Shaft	4
2	MP-0700-A-002	Carriage Roller Assembly	4
1	MP-0700-W-001	Carriage Weldment	1

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TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-0700-A-001.dwg

MP- 0400-A-002

MP- 0400-A-001

NEXT ASSEMBLY

SCALE: 1'0"=1'0"

DRAWN: rwv7089

CHECKED

APPROVED

DATE: 07/21/2004

WEIGHT: 290 LB.

FROM: n/a

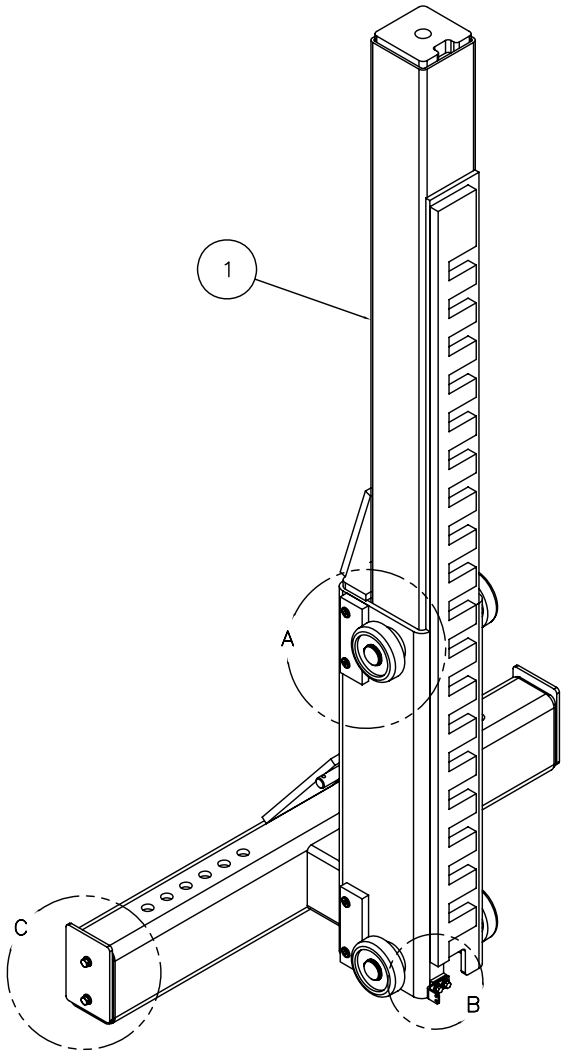
MOHAWK RESOURCES LTD.

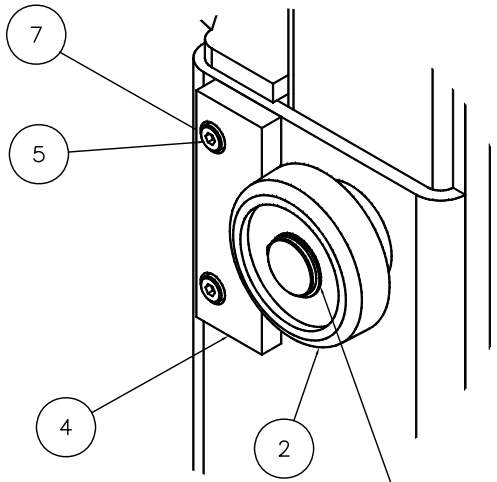
TITLE: Mobile Post Lift Carriage Assembly

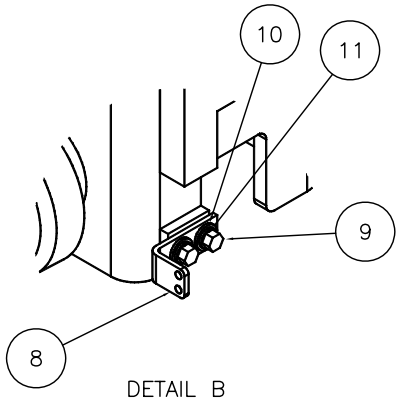
DRAWING NUMBER: MP-0700-A-001 D

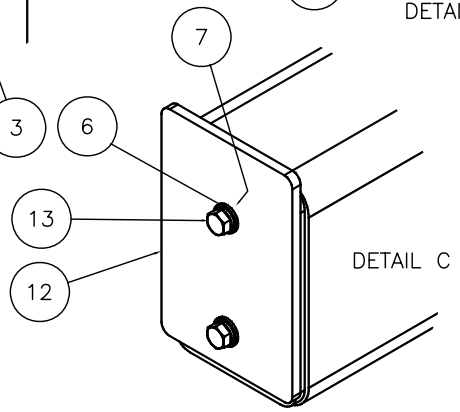
D-SIZE

#	DESCRIPTION	DATE	APPROVED
A	ITEM 5 WAS 600-650-013 (3/4" LONG)	05/12/2008	dak0879









WIDER

ITEM	NAME	DESCRIPTION	QTY
13	600-640-017	Bolt, Hex Head, 5/16-18 NC x 1 1/4" lg (Gr 5)	4
12	MP-0700-P-016	Tube End Stop	2
11	600-720-007	Washer, Lock, 1/4	2
10	600-710-004	Washer, Flat, 1/4	2
9	600-640-042	Bolt, Hex Head, 1/4-20 NC x 1/2 (GR5)	2
8	MP-0700-P-015	Cable Support Angle	1
7	600-710-003	Washer, Flat, 5/16	4
6	600-720-002	Washer, Lock, 5/16	12
5	600-650-016	Socket Cap Screw, 5/16-18 NC x 1" Lg	8
4	MP-0700-P-012	Slide Block, UHMW	4
3	600-870-001	Snap Ring, 1 3/8 Shaft	4
2	MP-0700-A-002	Carriage Roller Assembly	4
1	MP-1900-W-001	Carriage Weldment (WIDER)	1

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
.XX ± .030
.XXX ± .005

FILE NAME: MP-1900-A-001.dwg

MP-1900-

MP-1900-

NEXT ASSEMBLY

SCALE: 1/4

DRAWN: dak

CHECKED

APPROVED

DATE: 7/1/05

WEIGHT: 300 LB.

MOHAWK RESOURCES LTD.

TITLE: Mobile Post Lift Carriage Assembly

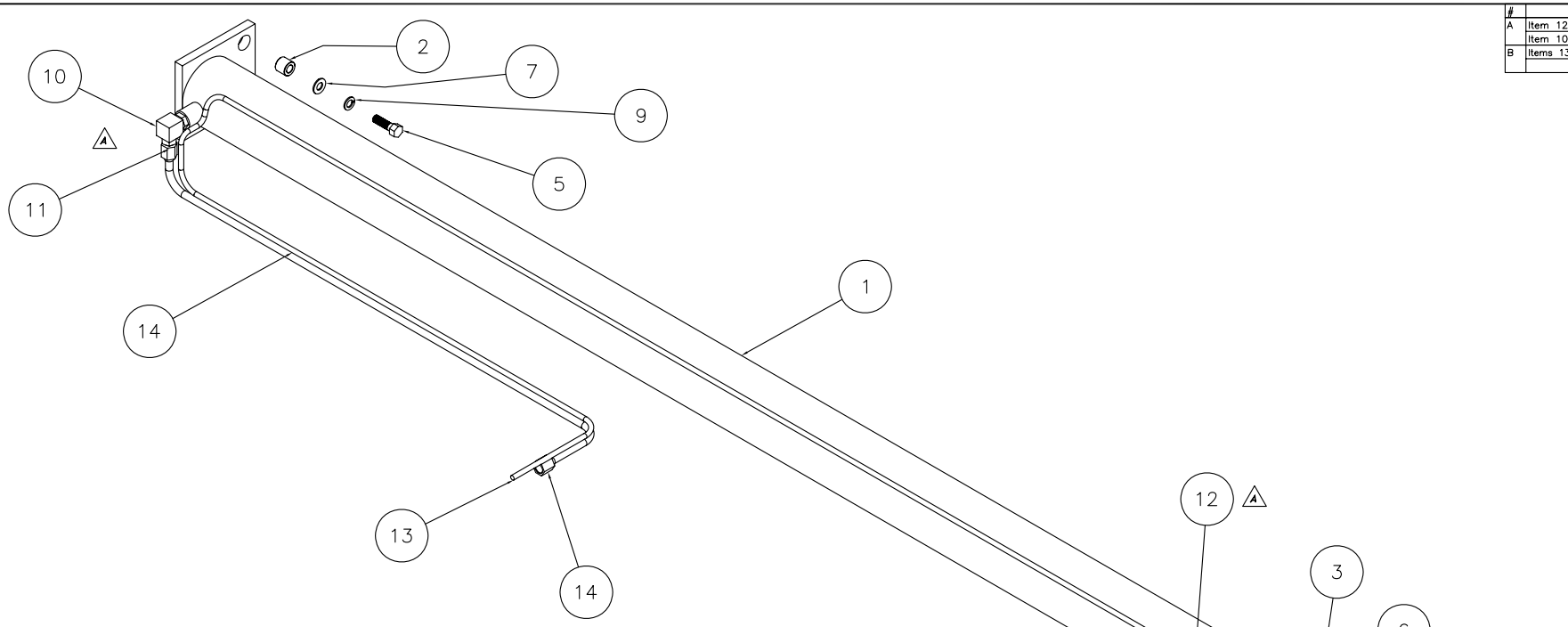
FROM

DRAWING NUMBER: MP-1900-A-001

A

D-SIZE

#	DESCRIPTION	DATE	APPROVED
A	Item 12 was 601-520-003	03/01/2005	rwv7089
	Item 10 was at 45 Degrees		
B	Items 13, 14, 15 & 16 Added	07/08/2005	rwv7089



15

USE TO SECURE BLACK TUBING TO CYLINDER BARREL (NOT SHOWN)

16

USE TO SECURE BLACK TUBING TO HYDRAULIC LINE (NOT SHOWN)

ITEM	NAME	DESCRIPTION	QTY
16	601-600-029	Pull Tie, Black, 8 1/2" Long	6
15	601-600-021	Pull Tie, Black, 15" Long	4
14	MP-1200-A-002	Tube Assembly	1
13	MP-0900-P-401	Tubing, Black Plastic, 1/4" x 115" Long	1
12	601-520-002	90° Elbow Swiv, 1/8 NPT To 1/4 Tube	1
11	601-420-019	Straight, #6 ORB to #6 JIC	1
10	601-410-073	Velocity Fuse, 5 GPM	1
9	600-720-011	Washer, Lock, 3/8	2
8	600-720-005	Washer, Lock, 1/2	1
7	600-710-009	Washer, Flat, 3/8	2
6	600-710-008	Washer, Flat, 1/2	1
5	600-640-095	Bolt, Hex Head, 3/8-16 NC x 1 1/4 (GR8)	2
4	600-640-030	Bolt, Hex Head, 1/2-13 NC x 2" (GR8)	1
3	MP-0900-P-003	Cylinder Rod Bushing	1
2	MP-0900-P-002	Cylinder Base Bushing	2
1	MP-0900-P-001	Cylinder Assembly, Purchased	1

Parts List

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP-0900-A-001.dwg*

MP-0400-A-002

MP-0400-A-001

NEXT ASSEMBLY

SCALE *1'0"=1'0"*

DRAWN *rwv7089*

CHECKED

APPROVED

DATE *09/08/2004*

WEIGHT *126* LB.

FROM *n/a*

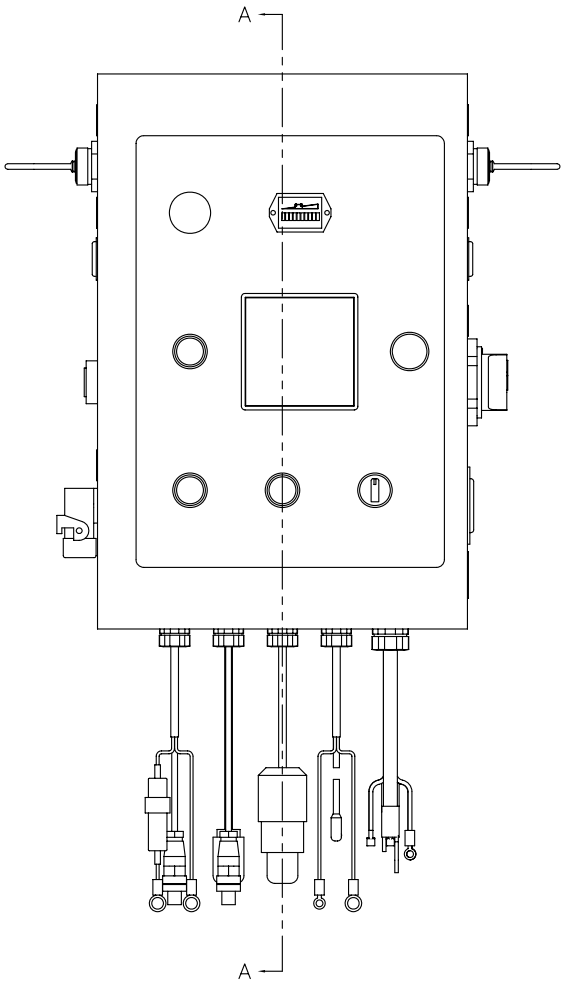
MOHAWK RESOURCES LTD.

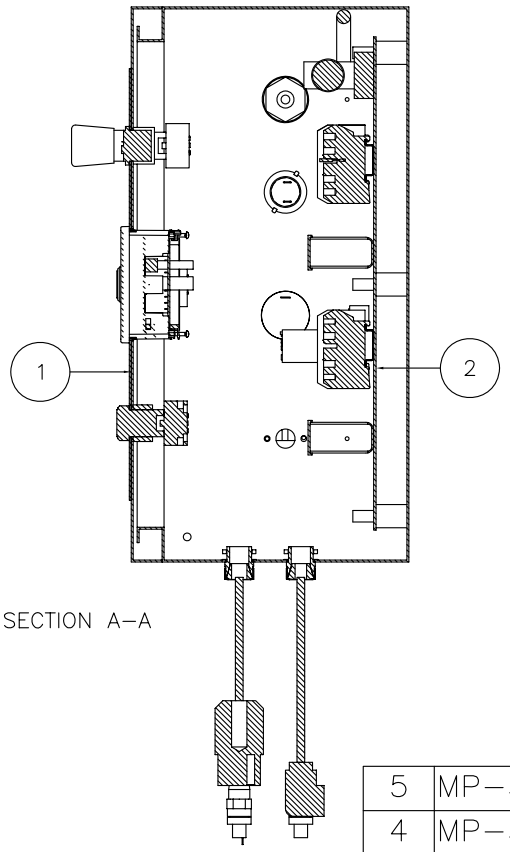
TITLE *Mobile Post Lift Cylinder Assembly*

DRAWING NUMBER *MP-0900-A-001* B

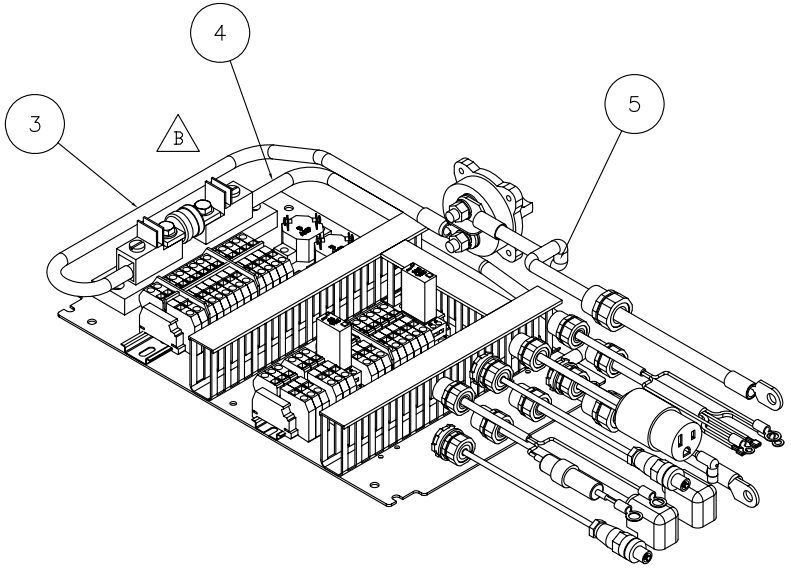
D-SIZE

#	DESCRIPTION	DATE	APPROVED
A	View of Bottom Pigtails Revised	06/18/2008	rwv7089
B	Item 3 was MP-5100-A-007 Item 4 was MP-5100-A-008	08/15/2008	rwv7089





SECTION A–A



B

ITEM	NAME	DESCRIPTION	QTY
5	MP-5100-A-009	Cable Assy, 48" Lg, Red	1
4	MP-5100-A-023	Cable Assy, 36" Lg, Red	1
3	MP-5100-A-024	Cable Assy, 18" Lg, Red	1
2	MP-5100-A-004	Master Panel Assembly	1
1	MP-5100-A-003	Master Enclosure Assembly	1

Parts List

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TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL
0.XX ± .030
0.XXX ± .005

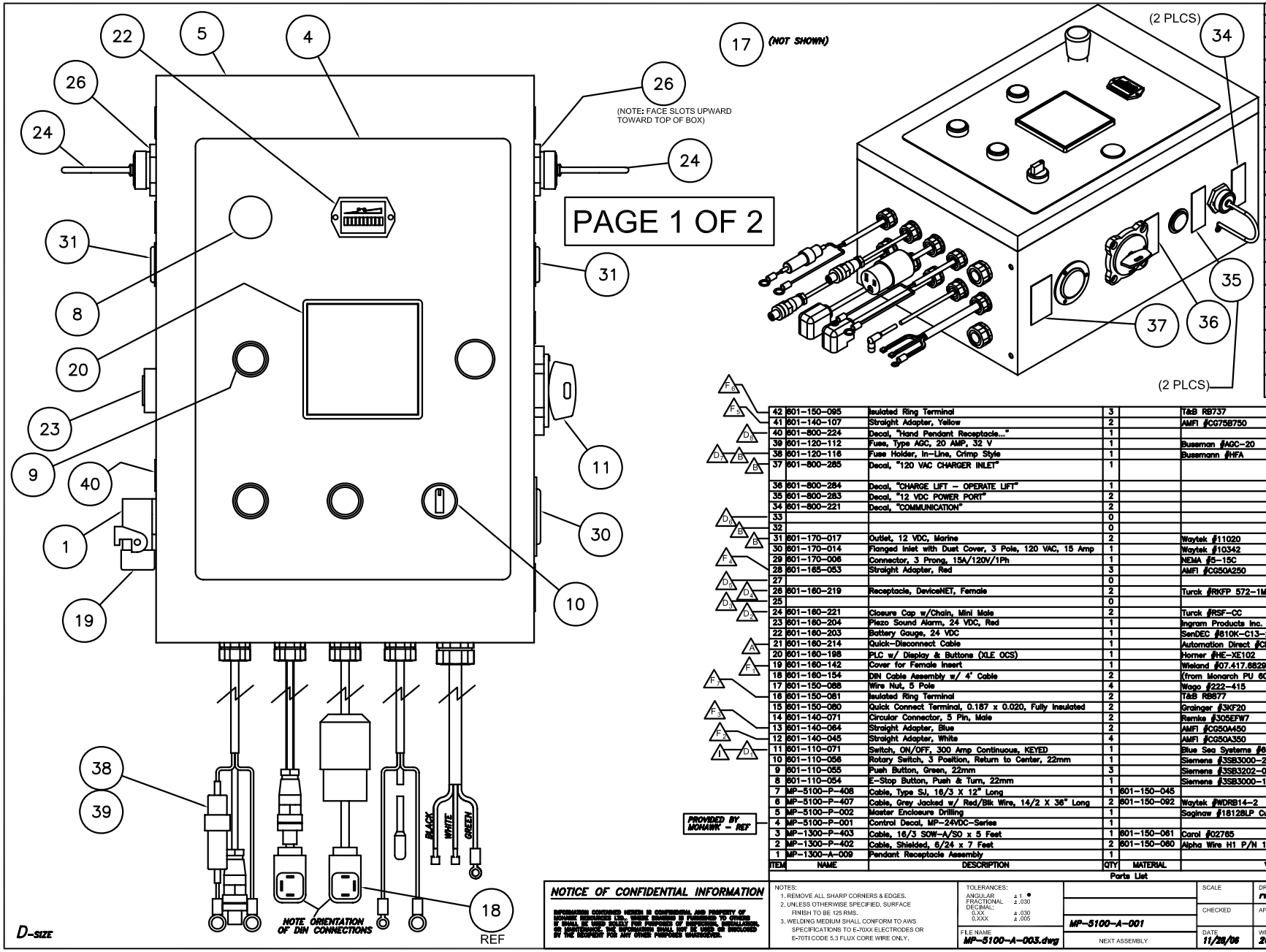
FILE NAME: MP-5100-A-001

MP-51

NEXT ASSEMBLY

SCALE: 1/2	DRAWN: rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE: MP-24VDC-SERIES Master Box Assy	
DATE: 11/30/06	WEIGHT: 30 LB.	FROM: n/a	DRAWING NUMBER: MP-5100-A-001 B

D-SIZE



#	DESCRIPTION	DATE	APPROVED
A	ITEM 21 WAS 601-160-200	03/26/2007	dak0879
B	1. Item 31 was 601-170-015 2. Item 32 was 601-170-016	04/18/2007	rwv7089
B	3. Item 38 & 39 Added	04/19/2007	rwv7089
C	Items 2 & 14 were qty 1. Item 22 new supplier	05/08/2007	rwv7089
D	1. Item 11 was 601-110-066 2. Item 24 was 601-160-205	06/18/2007	rwv7089
	3. Item 25 was 601-160-206 4. Item 26 was 601-160-209	06/18/2007	rwv7089
	5. Item 27 was 601-160-210 6. Item 33 was 601-800-216	06/18/2007	rwv7089
	7. Item 38 was 601-120-111 8. Item 40 Added.	06/18/2007	rwv7089
E	Wire Strip Lengths Added Wiring for String Pot and Sensor Revised	08/12/2007	rwv7089
F	1) ITEM 19 WAS 601-150-188 2) ITEM 12 WAS QTY OF 2 3) ITEM 13 WAS QTY OF 3 4) ITEM 28 WAS QTY OF 6 5) ITEM 41 (601-140-107) ADDED 6) ITEM 42 (601-150-095) ADDED 7) ITEM 16 WAS QTY 1 8) CHART CHANGED 9) ITEM 24 WAS INCORRECT	10/08/2007	dak0879
G	Bottom of Box Port Orientations Revised (See Page 2 of 2)	06/18/2008	rwv7089
H	Orientation of Bottom Ports back to REV F.	08/15/2008	rwv7089
I	ITEM 11 WAS 601-110-67	06/10/2010	G.GORE

ITEM	NAME	DESCRIPTION	QTY	MATERIAL	VENDOR	NOTE	MASS	PRICE
42	601-150-095	Insulated Ring Terminal	3		T&B RB737		0.003	
41	601-140-107	Straight Adapter, Yellow	2		AMFI #CG758750		0.170	
40	601-800-224	Decal, "Hand Pendant Receptacle..."	1			1" x 3"	0.000	
39	601-120-112	Fuse, Type AGC, 20 AMP, 32 V	1		Bussman #AGC-20		0.050	
38	601-120-116	Fuse Holder, In-Line, Crimp Style	1		Bussmann #HFA		0.010	
37	601-800-285	Decal, "120 VAC CHARGER INLET"	1			1 1/2 x 2 1/2	0.000	
36	601-800-284	Decal, "CHARGE LIFT – OPERATE LIFT"	1			1" x 2 1/2	0.000	
35	601-800-283	Decal, "12 VDC POWER PORT"	2			1" x 2 1/2	0.000	
34	601-800-221	Decal, "COMMUNICATION"	2			1" x 2 1/2	0.000	
33			0					
32			0				0.000	
31	601-170-017	Outlet, 12 VDC, Marine	2		Waytek #11020		0.100	
30	601-170-014	Flanged Inlet with Dust Cover, 3 Pole, 120 VAC, 15 Amp	1		Waytek #10342		0.500	
29	601-170-006	Connector, 3 Prong, 15A/120V/1Ph	1		NEMA #5-15C		0.300	
28	601-165-053	Straight Adapter, Red	3		AMFI #CG50A250		0.150	
27			0				0.000	
26	601-160-219	Receptacle, DeviceNET, Female	2		Turck #RKFP 572-1M		1.000	
25			0				0.000	
24	601-160-221	Closure Cap w/Chain, Mini Male	2		Turck #RSF-CC		0.037	
23	601-160-204	Piezo Sound Alarm, 24 VDC, Red	1		Ingram Products Inc. #PW24D-Red			
22	601-160-203	Battery Gauge, 24 VDC	1		SenDEC #810K-C13-222 (F1-0721)			
21	601-160-214	Quick-Disconnect Cable	1		Automation Direct #CD08-0A-020-C1		0.168	
20	601-160-198	PLC w/ Display & Buttons (XLE OCS)	1		Horner #HE-XE102		1.500	
19	601-160-142	Cover for Female Insert	1		Wieland #07.417.6829.0		0.070	
18	601-160-154	DIN Cable Assembly w/ 4' Cable	2		(from Monarch PU 601-300-073)		0.750	
17	601-150-088	Wire Nut, 5 Pole	4		Wago #222-415		0.050	
16	601-150-081	Insulated Ring Terminal	2		T&B RB877		0.003	
15	601-150-080	Quick Connect Terminal, 0.187 x 0.020, Fully Insulated	2		Grainger #3KF20		0.001	
14	601-140-071	Circular Connector, 5 Pin, Male	2		Remke #305EFW7		0.100	
13	601-140-064	Straight Adapter, Blue	2		AMFI #CG50A450		0.150	
12	601-140-045	Straight Adapter, White	4		AMFI #CG50A350		0.150	
11	601-110-071	Switch, ON/OFF, 300 Amp Continuous, KEYED	1		Blue Sea Systems #6005		0.750	
10	601-110-056	Rotary Switch, 3 Position, Return to Center, 22mm	1		Siemens #3SB3000-2EA11 / (2) 3SB3400-0B		0.106	
9	601-110-055	Push Button, Green, 22mm	3		Siemens #3SB3202-0AA41		0.106	
8	601-110-054	E-Stop Button, Push & Turn, 22mm	1		Siemens #3SB3000-1HA20/3SB3400-0C		0.106	
7	MP-5100-P-408	Cable, Type SJ, 16/3 X 12" Long	1	601-150-045			0.500	
6	MP-5100-P-407	Cable, Grey Jacked w/ Red/Blk Wire, 14/2 X 36" Long	2	601-150-092	Waytek #WDRB14-2		0.500	
5	MP-5100-P-002	Master Enclosure Drilling	1		Saginaw #18128LP Custom		15.000	
4	MP-5100-P-001	Control Decal, MP-24VDC-Series	1			10" x 14"	0.100	
3	MP-1300-P-403	Cable, 16/3 SOW-A/SO x 5 Feet	1	601-150-061	Carol #02765		0.525	
2	MP-1300-P-402	Cable, Shielded, 6/24 x 7 Feet	2	601-150-060	Alpha Wire H1 P/N 1216C		0.500	
1	MP-1300-A-009	Pendant Receptacle Assembly	1				0.250	

PROVIDED BY MOHAWK – REF

Parts List

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TOLERANCES:
ANGULAR ± 1.0°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5100-A-003.dwg

MP-5100-A-001

NEXT ASSEMBLY

SCALE

DRAWN: rwv7089

CHECKED

APPROVED

DATE: 11/28/06

WEIGHT: 26.5 LB.

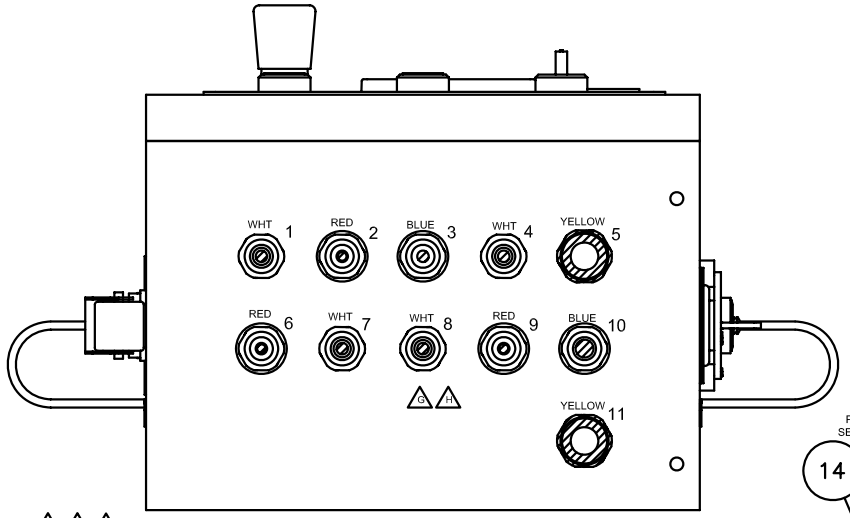
FROM: N/A

MOHAWK RESOURCES LTD.

TITLE: MP-24VDC-SERIES Master Enclosure Box Assy

DRAWING NUMBER: MP-5100-A-003

D-SIZE



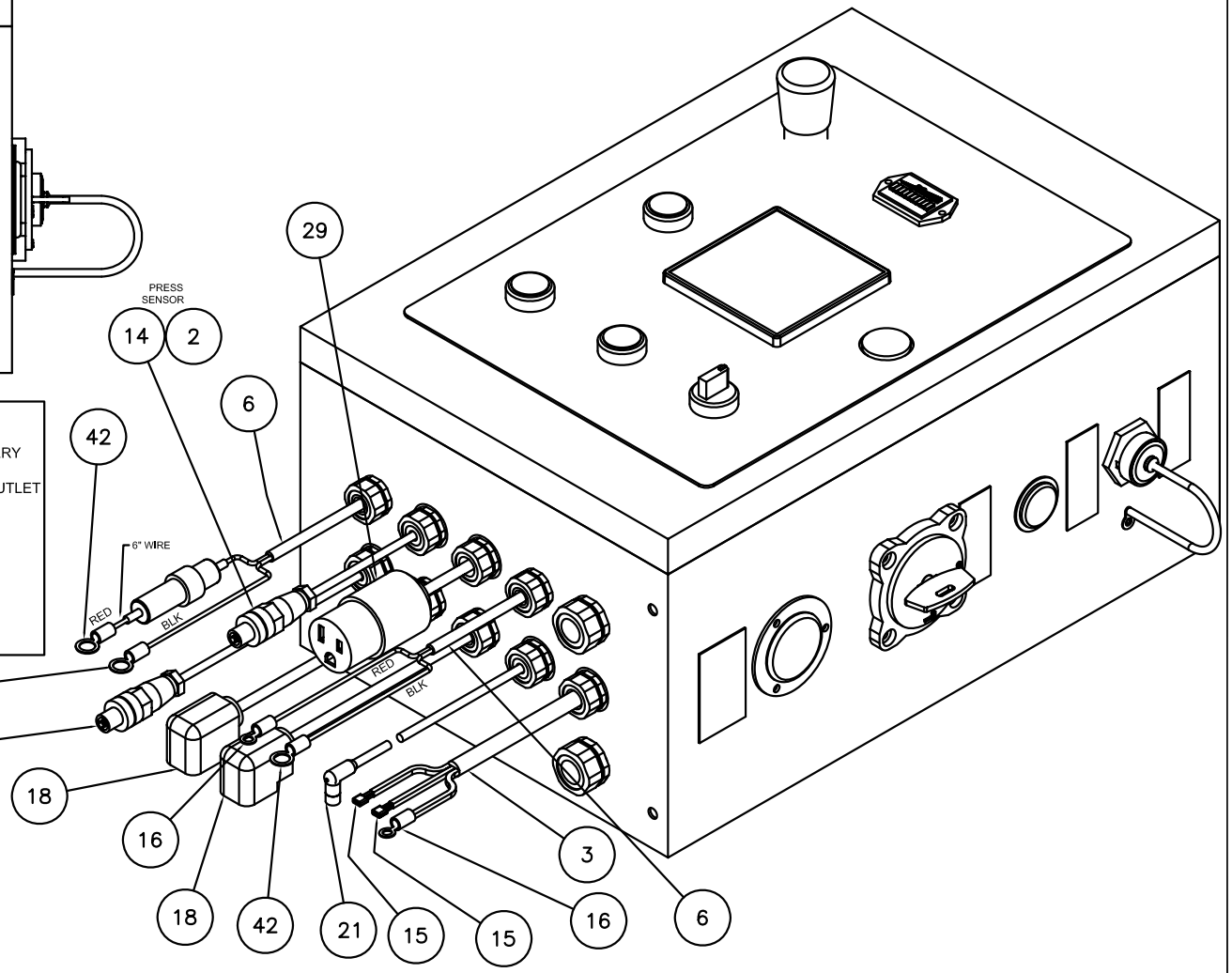
F, E, G

PORT#	FITTING#	EXPOSED LG	TOTAL LG	DESCRIPTION
1	12 (WHT)	40" (Strip 8")	72"	12 VDC POWER OUTLETS TO LEFT BATTERY
2	28 (RED)	12"	42"	PRESSURE SENSOR
3	13 (BLUE)	12"	36"	CHARGER POWER CABLE TO 120 VAC OUTLET
4	12 (WHT)	24" (Strip 8")	51"	MOTOR CONTACTOR & MAIN GROUND
5	41 (YEL)	40"	50"	ON/OFF (+) TO RIGHT BATTERY (+)
6	28 (RED)	96"	126"	LINEAR TRANSDUCER (YO-YO)
7	12 (WHT)	18"	Factory Lg	50% DOWN SOLENOID (LEFT)
8	12 (WHT)	18"	Factory Lg	100% DOWN SOLENOID (RIGHT)
9	28 (RED)	60"	Factory Lg	PROXIMITY SENSOR @ LOCK
10	13 (BLUE)	60" (Strip 5")	80"	LOCK SOLENOID
11	41 (YEL)	20"	48"	FROM 150A C/B (+) TO MOTOR SOLE

WIRING:
String Pot:
Pin #1: Red
Pin #2: Black
n/c: White
n/c: Shield

E

Pressure Sensor:
Pin #1: Red
Pin #2: Black
n/c: White
n/c: Shield



PAGE 2 OF 2

D-SIZE

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TOLERANCES:
ANGULAR ± 1 °
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5100-A-003.dwg

MP-5100-A-001

NEXT ASSEMBLY

SCALE

DRAWN: rwv7089

CHECKED

APPROVED

DATE: 11/28/06

WEIGHT: 26.5 LB.

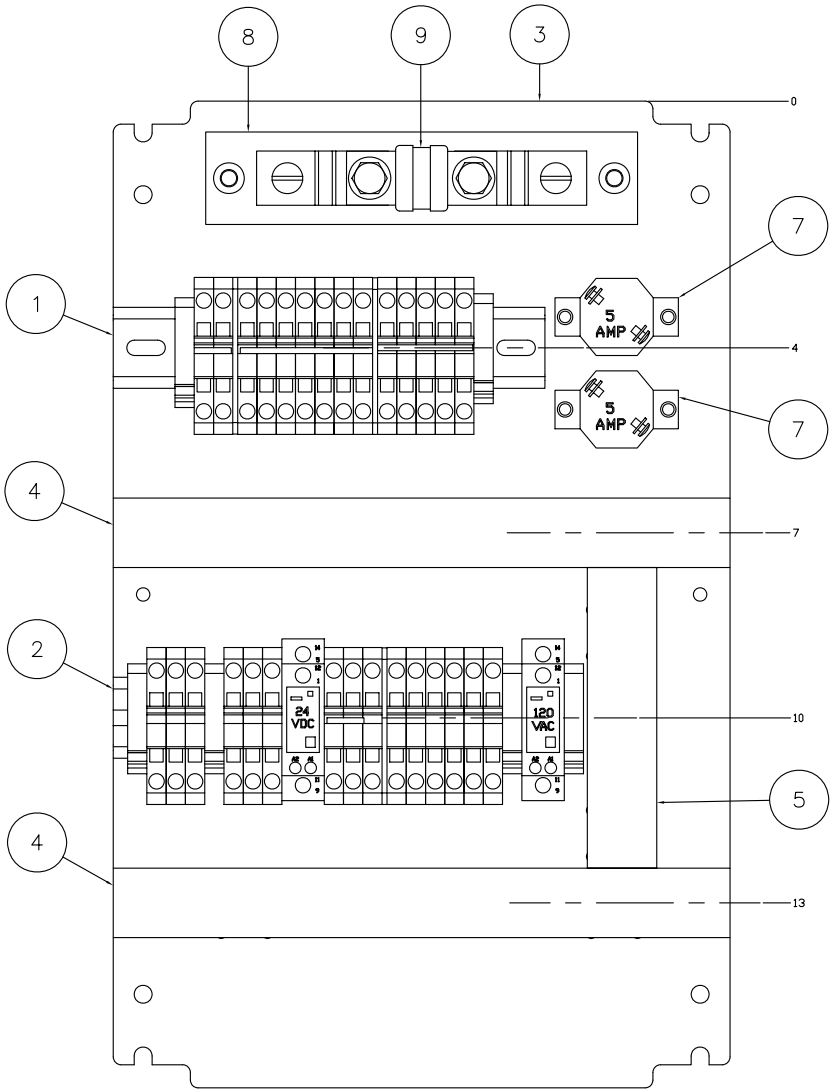
FROM: N/A

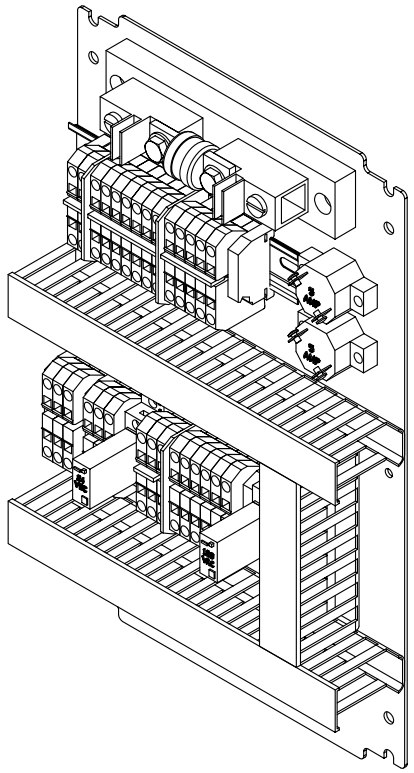
MOHAWK RESOURCES LTD.

TITLE: MP-24VDC-SERIES Master Enclosure Box Assy

DRAWING NUMBER: MP-5100-A-003

H





#	DESCRIPTION	DATE	APPROVED
A	1. Item 5 was 601-130-113.	06/18/2007	rwv7089
	2. Item 6 was 601-120-109. (qty2)		
	3. Item 7 was 601-120-107.	06/18/2007	rwv7089
	4. Item 8 was MP-5100-P-015.		
B	1. Item 6 was 601-120- (was 150 Amp Circuit Breaker)	08/15/2008	rwv7089
	2. Item 8 & 9 Added	08/15/2008	rwv7089

ITEM	NAME	DESCRIPTION	QTY
9	601-120-117	Fuse, 200 Amp, Fast Acting, Class T	1
8	601-120-118	Fuse Holder, 200 Amp, Class T	1
7	601-120-115	Circuit Breaker, 5 Amp, Auto Reset	2
6			0
5	MP-5100-P-015	Wire Ducting, 1" x 2" High x 4 7/8 Long	1
4	MP-5100-P-014	Wire Ducting, 1" x 2" High x 10" Long	2
3	MP-5100-P-004	Panel Drilling	1
2	MP-5100-A-021	Terminal Strip Assy #2, TR-Series	1
1	MP-5100-A-020	Terminal Strip Assy #1	1

Parts List

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TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5100-A-004

MP-5100-A-

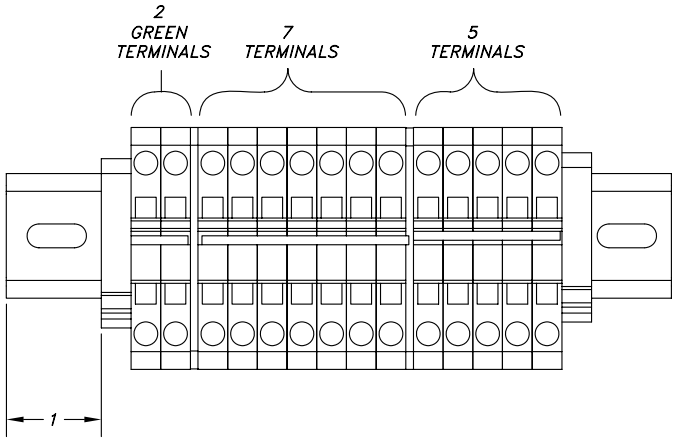
NEXT ASSEMBLY

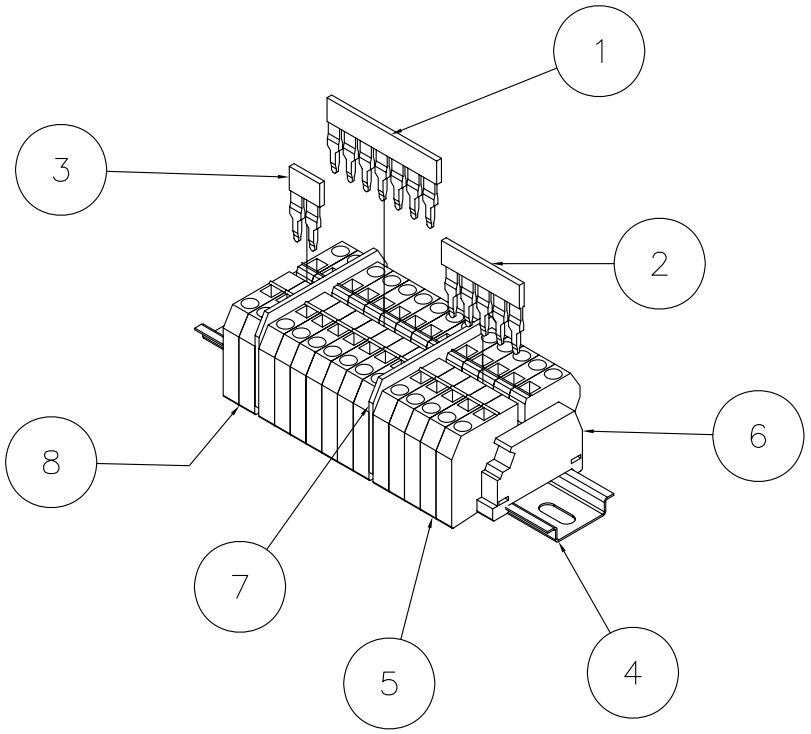
SCALE: 1/2
CHECKED
DATE: 11/30/06

DRAWN: rwv7089
APPROVED
WEIGHT: 15 LB.

MOHAWK RESOURCES LTD.
TITLE: MP-24VDC-SERIES Master Panel Assy
FROM: n/a
DRAWING NUMBER: MP-5100-A-004
B

D-SIZE





ITEM	NAME	DESCRIPTION	QTY
8	601-165-068	Terminal Block, Screwless, Green (For Grounding)	2
7	601-165-063	End Cover, Screwless Terminal Strip	2
6	601-165-061	End Stop	2
5	601-165-059	Terminal Block, Screwless, Grey	12
4	MP-5100-P-009	Din Rail, 7 Lg	1
3	MP-5100-P-013	Top Jumper Bar, 2 Pole, Screwless	1
2	MP-5100-P-012	Top Jumper Bar, 5 Pole, Screwless	1
1	MP-5100-P-011	Top Jumper Bar, 7 Pole, Screwless	1

Parts List

C-SIZE

NOTICE OF CONFIDENTIAL INFORMATION

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5100-A-020

MP-5100-A-

MP-5100-A-

NEXT ASSEMBLY

SCALE: 3/4
DRAWN: rwv7089
CHECKED
APPROVED
DATE: 11/27/06
WEIGHT: 1.4 LB.

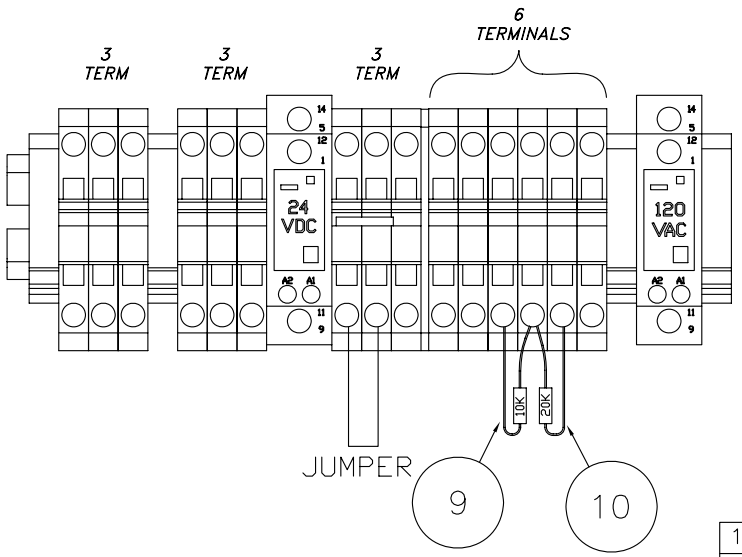
MOHAWK RESOURCES LTD.

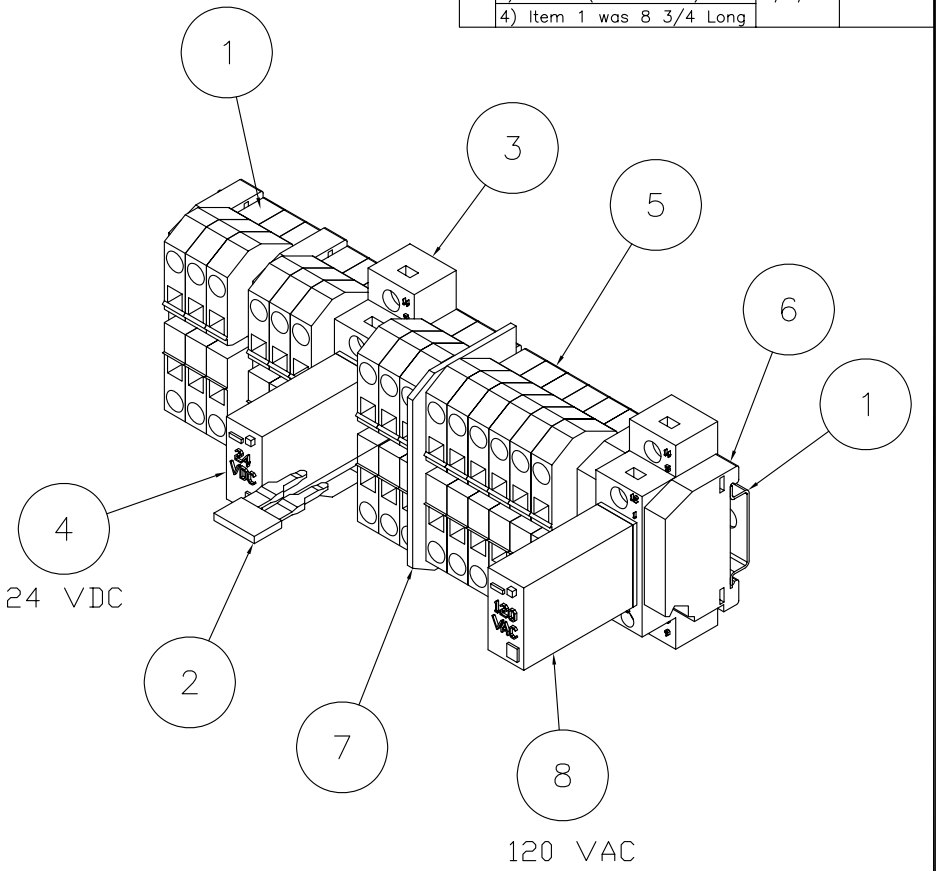
TITLE: MP-24VDC-SERIES Terminal Strip Assy #1

FROM: n/a

DRAWING NUMBER: MP-5100-A-020

#	DESCRIPTION	DATE	APPROVED
A	1) ONE ITEM 5 (601-165-059) ADDED	03/27/2007	
	2) ITEM 9 (601-160-215) ADDED		
	3) ITEM 10 (601-160-216) ADDED	03/27/2007	dak0879
	4) Item 1 was 8 3/4 Long		





ITEM	NAME	DESCRIPTION	QTY
10	601-160-216	Resistor, 20k Ohm	1
9	601-160-215	Resistor, 10k Ohm	1
8	601-160-144	Relay, Miniature, SPDT, 15 A, 120 VAC Coil, LED w/Bypass	1
7	601-165-063	End Cover, Screwless Terminal Strip	1
6	601-165-061	End Stop	4
5	601-165-059	Terminal Block, Screwless, Grey	15
4	601-160-196	Relay, Miniature, SPDT, 15 A, 24 VDC Coil, LED w/Bypass	1
3	601-160-146	Relay Socket, Screw Terminal	2
2	MP-5100-P-013	Top Jumper Bar, 2 Pole, Screwless	1
1	MP-5100-P-010	Din Rail, 7 5/8 Lg	1

Parts List

C-SIZE

NOTICE OF CONFIDENTIAL INFORMATION

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NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70TI CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME MP-5100-A-021

MP-5100-A-

MP-5100-A-

NEXT ASSEMBLY

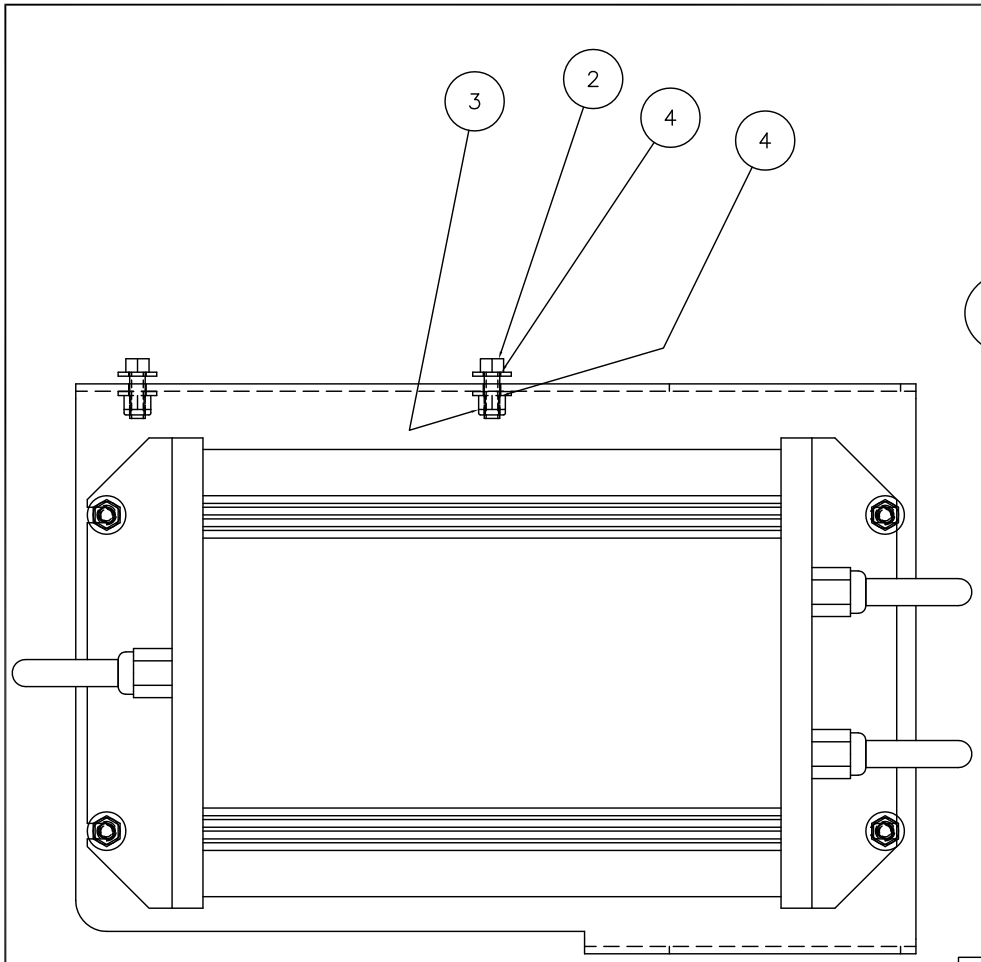
SCALE 3/4 | DRAWN rwv7089 | CHECKED | APPROVED | DATE 11/27/06 | WEIGHT 1.4 LB.

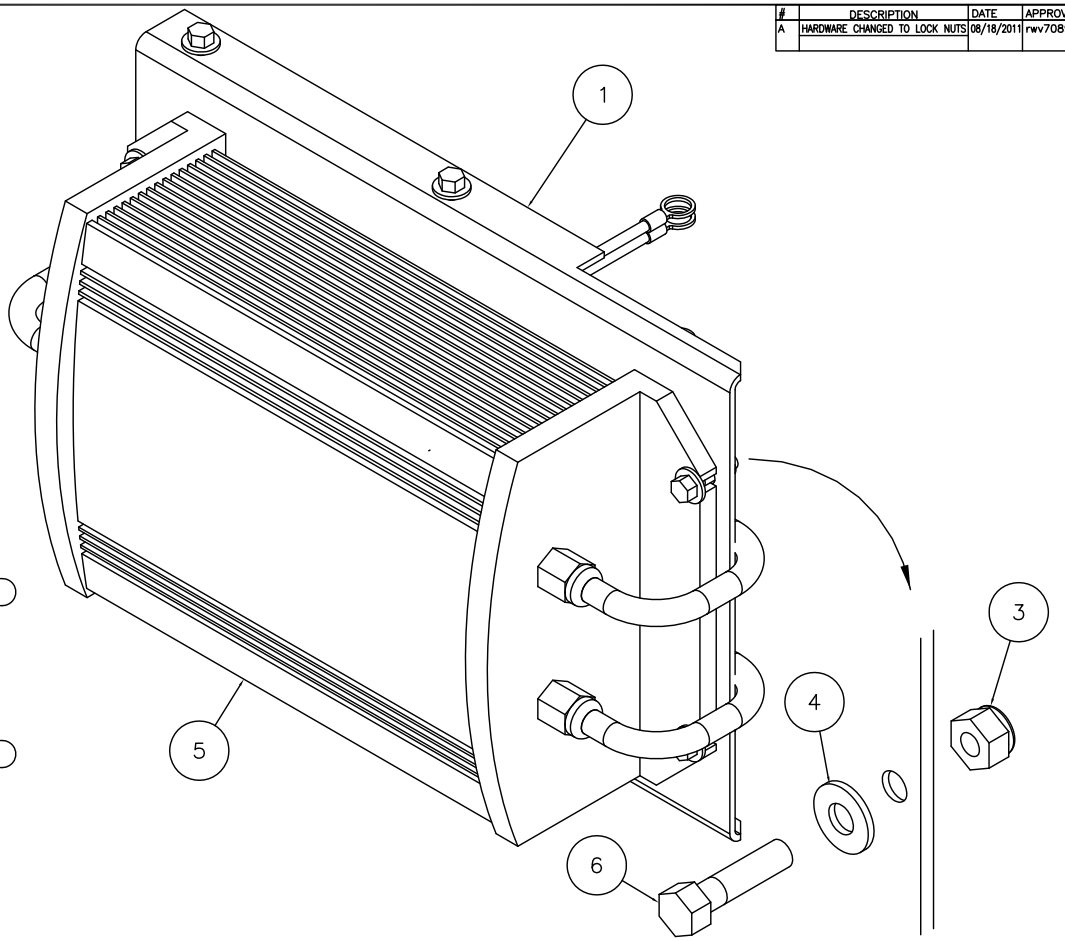
MOHAWK RESOURCES LTD.

TITLE MP-24VDC-SERIES Terminal Strip Assy #2

FROM n/a | DRAWING NUMBER MP-5100-A-02 | A

#	DESCRIPTION	DATE	APPROVED
A	HARDWARE CHANGED TO LOCK NUTS	08/18/2011	rwv7089





ITEM	NAME	DESCRIPTION	QTY
6	600-640-004	Bolt, Hex Head, 1/4-20 NC x 1" (GR5)	4
5	601-160-270	Battery Charger, 20 Amp, Dual 12 VDC Output	1
4	600-710-004	Washer, Flat, 1/4	8
3	600-690-005	Nut, Nylon Lock, 1/4-20 NC	6
2	600-640-013	Bolt, Hex Head, 1/4-20 NC x 3/4 (GR5)	2
1	MP-5100-P-025	Charger Mounting Bracket	1

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
.XX ± .030
.XXX ± .005

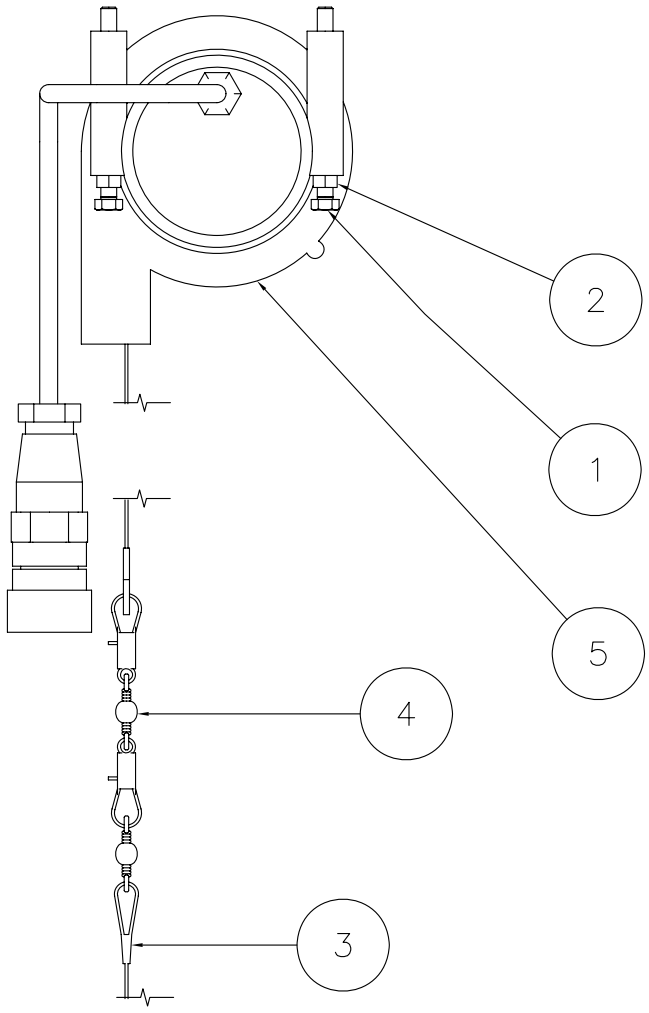
FILE NAME: MP-5100-A-012

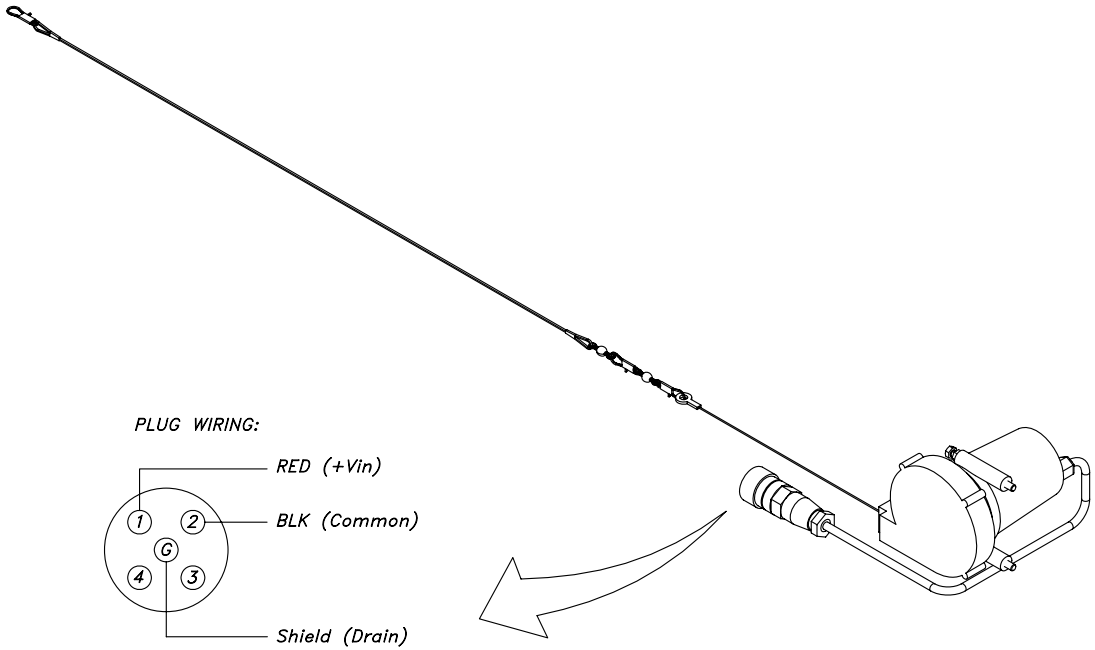
MP-

NEXT ASSEMBLY

SCALE	DRAWN	MOHAWK RESOURCES LTD.	
1=1	G.GORE		
CHECKED	APPROVED	TITLE: MP-18 24VDC Charger Assembly	
DATE: 8/01/11	WEIGHT: 24.75 LB.	FROM: n/a	DRAWING NUMBER: MP-5100-A-012

D-SIZE





ITEM	NAME	DESCRIPTION	QTY
5	601-160-201	Linear Position Sensor, NEMA 4X, ANALOG	1
4	600-850-019	Double Swivel	1
3	600-850-018	Leader Line, 18" Long	1
2	600-680-028	Nut, Plain, #8-32 NC	2
1	600-600-021	Hex Machine Screw, #8-32NC x 2" Lg	2

Parts List

C-SIZE

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5100-A-014.dwg

MP-5400-A-002

MP-5400-A-001

NEXT ASSEMBLY

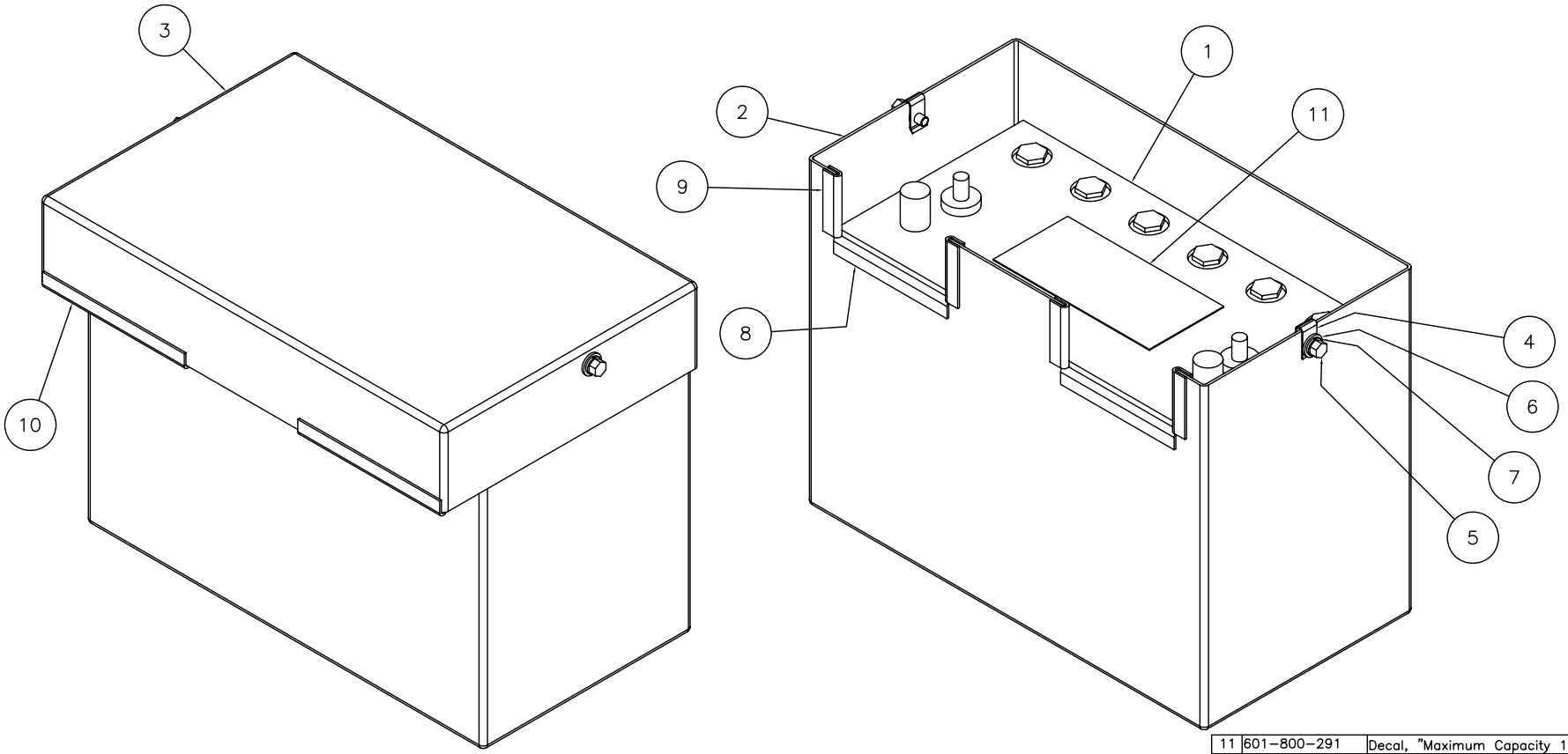
SCALE: 1'0"=1'0"
DRAWN: rwv7089
CHECKED
APPROVED
DATE: 11/2/2004
WEIGHT: 0.70 LB.

MOHAWK RESOURCES LTD.

TITLE: Mobile Post Lift String Pot Assembly, ANALOG

FROM: N/A

DRAWING NUMBER: MP-5100-A-014



ITEM	NAME	DESCRIPTION	QTY
11	601-800-291	Decal, "Maximum Capacity 18000 LBS"	1
10	MP-5300-P-405	Trim Molding, 5" Long, 1/16 Sheet Metal	2
9	MP-5300-P-404	Trim Molding, 1 7/8" Long, 1/16 Sheet Metal	4
8	MP-5300-P-403	Trim Molding, 4" Long, 1/16 Sheet Metal	2
7	600-720-007	Washer, Lock, 1/4	2
6	600-710-004	Washer, Flat, 1/4	2
5	600-640-042	Bolt, Hex Head, 1/4-20 NC x 1/2 (GR5)	2
4	601-200-010	U-Nut, Automotive, 1/4-20	2
3	MP-5300-P-004	Battery Box Top	1
2	MP-5300-P-003	Battery Box Bottom	1
1	601-190-011	Battery, 12VDC	1

Parts List

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TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL
.XX ± .030
.XXX ± .005

FILE NAME: *MP-5300-A-001*

MP-

NEXT ASSEMBLY

SCALE: *3/4*
DRAWN: *rwv7089*
CHECKED:
APPROVED:
DATE: *4/07*
WEIGHT: *85.6* LB.

MOHAWK RESOURCES LTD.

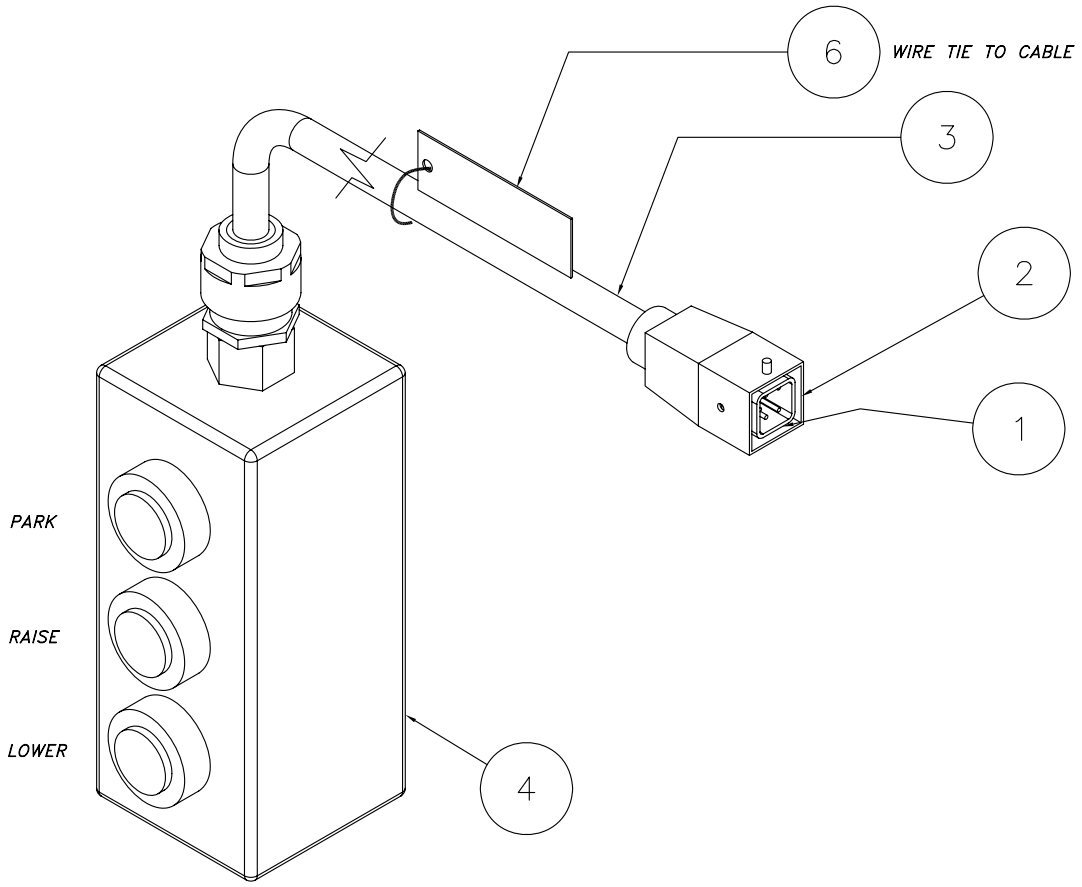
TITLE: *Battery Box Assembly*

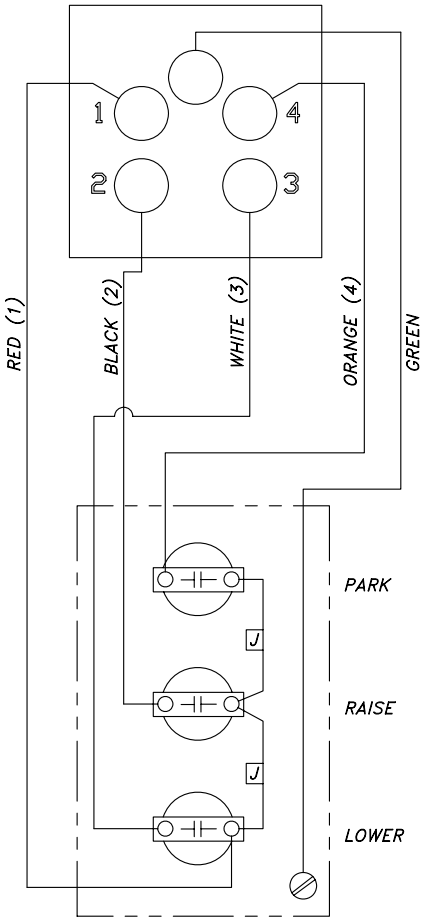
FROM: *n/a*
DRAWING NUMBER: *MP-5300-A-001*

D-SIZE

CERTIFIABLE OPTION WITH X-PROOF PENDANT.

#	DESCRIPTION	DATE	APPROVED
A	1.ITEM 1 WAS 601-160-138	11/29/2006	dak





ITEM	NAME	DESCRIPTION	QTY
6	601-800-223	Plastic Tag, "Hand Pendant Option..."	1
5	601-140-046	Connector, 1/2 NPT, 1/2"-5/8" Cable (Brown)	1
4	601-160-168	Pendant, 3 Button, Class I, Div 2	1
3	601-150-082	Cable, 18/5 SOW x 25 Feet	1
2	601-160-139	Hood, Straight, Metallic w/ cable gland, PENDANT	1
1	601-160-193	4-Pin Insert, Male, PENDANT	1

A1

Parts List

C-SIZE

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-1300-A-020.dwg

NEXT ASSEMBLY

SCALE: 1'0"=1'0"
DRAWN: rwv7089
CHECKED
APPROVED
DATE: 10/10/2005
WEIGHT: 3 LB.

MOHAWK RESOURCES LTD.

TITLE: Mobile Post Lift Pendant Assembly

FROM: N/A
DRAWING NUMBER: MP-1300-A-020
A

MOHAWK

ILLUSTRATIONS

MP-18-24VDC-SERIES

ELECTRIC/HYDRAULIC
PORTABLE LIFT

Charger Status Lights:

Each post comes equipped with a dual battery charger which provides charging for two 12 VDC batteries (in series makes 24 VDC). Each charger is rated for 120 VAC, 60 Hz, 4 Amp draw. Keep this in mind if using extension cords and multiple adapters into a single outlet. (4 chargers will draw 4 x 4 amps = 16 amps total). There are three charging levels that the charger progresses through to full charge. Refer to the MINN KOTA MK220D manual enclosed at end of this manual. Bank 1 Refers to battery on the left (as viewed from the control box), Bank 2 is battery on the right (under the charger).

Note that to protect the charger, the lift will not function when power is supplied to the charger receptacle. Once power is supplied to charger receptacle, “Power On” light illuminates on charger and lift control panel will power.

Bulk Charging Mode: Each bank will show **Solid Yellow Lights**. (charger delivers full current to batteries until they reach ~75% charge)

Absorption Charging Mode: Each bank will show **Flashing Yellow Lights**. (charging current tapers down while battery voltages held at 14.4V at 77DegF.)

Maintenance / Float Charging Mode: Each bank will show **Flashing Green Lights**. (charger voltage dropped to 13.4V per bank to maintain full charge on battery)

Ready: Each bank will show **Solid Green Lights**. (batteries have been in maintenance mode for more than 24 hrs).

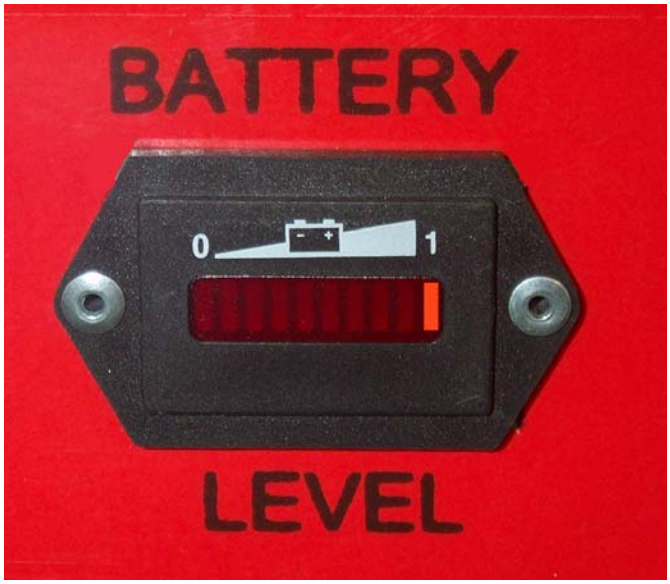
Any **Red Light** would indicate error in charging. Consult charger section for details.

NOTE: Avoid halting charging cycle until batteries are fully charged (this may decrease the life and charge holding capacity of the batteries). Do not recharge fully charged batteries. Status of left battery may differ from status of right battery. Wait until both batteries are fully charged prior to using lift.

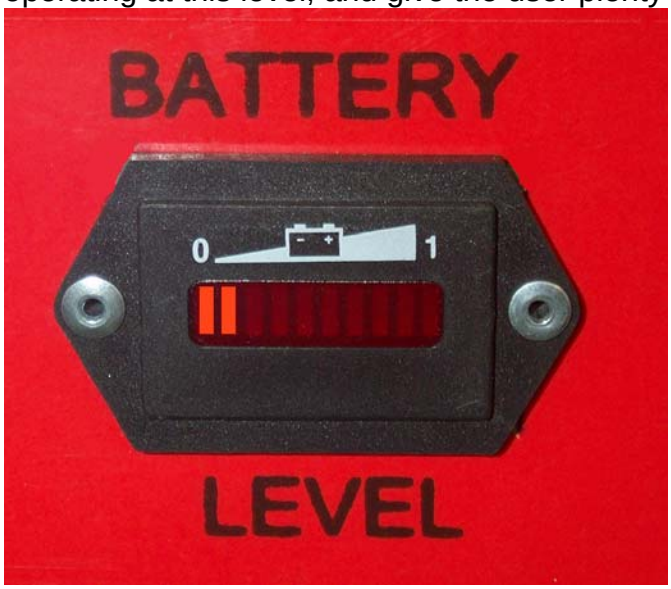
Battery Status Indicator:

The front panel of each post has a battery level indicator which shows the current charge of the batteries. (Battery level is also available by pressing the F3 button.) Be aware that the lower the battery level is, the higher the amp draw, and thus the deeper the level of charge drawn by the batteries. Paying attention to these meters and using a regular recharge routine will provide the user with years of trouble free usage.

Battery Full: This shows the battery at fully energized state. When depleted, the battery level meter will only “reset” to full after the battery has been fully charged.



Battery Low: (Both lights alternate flash). This shows the battery at 80% discharge. Use of the lift below this level may damage the batteries. The controls on this unit will prevent the lift from operating at this level, and give the user plenty of warning before approaching this discharged state.

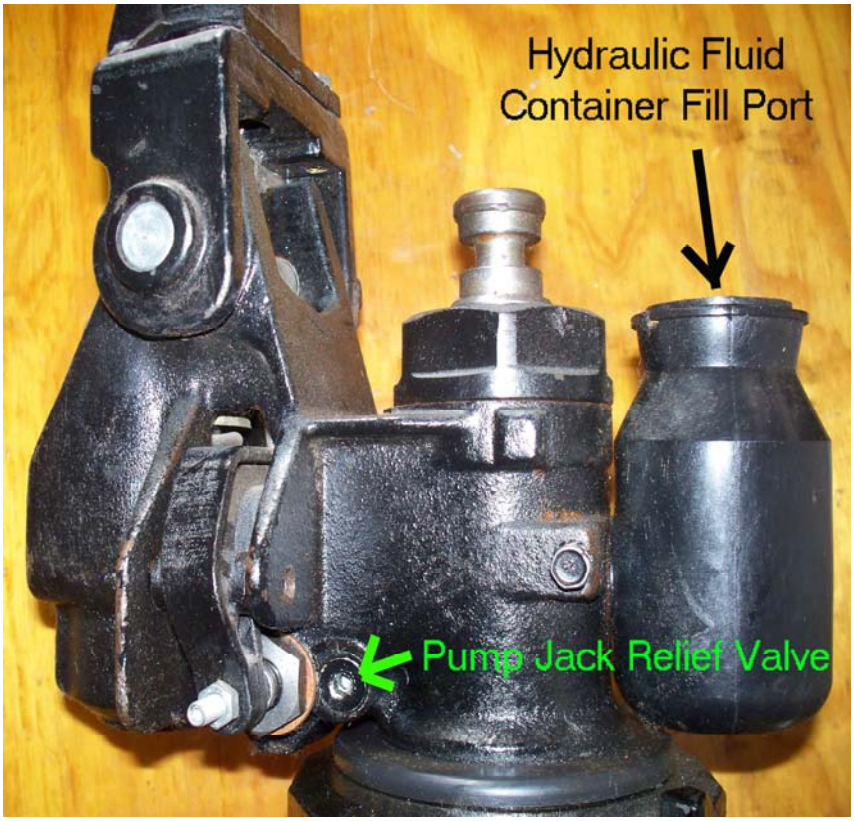


Jack Operation:

Prior to moving posts, the rear jack wheels must be engaged. To do this, push black lever down, then jack handle to desired height. When post is in position, collapse jack wheel fully by pulling black lever up.

Jack Relief Adjustment:

If jack does not collapse under load or if jack does not raise back of post onto wheel, then the relief valve may need to be adjusted. To set proper jack capacity, lift empty post with jack, then remove relief port cap with 5mm allen wrench (see location to right). Using 5mm allen wrench SLOWLY turn adjustment screw counter-clockwise until jack collapses. Then screw in clockwise 1 full turn. Replace port cap.



24 VDC MASTER ENCLOSURE:

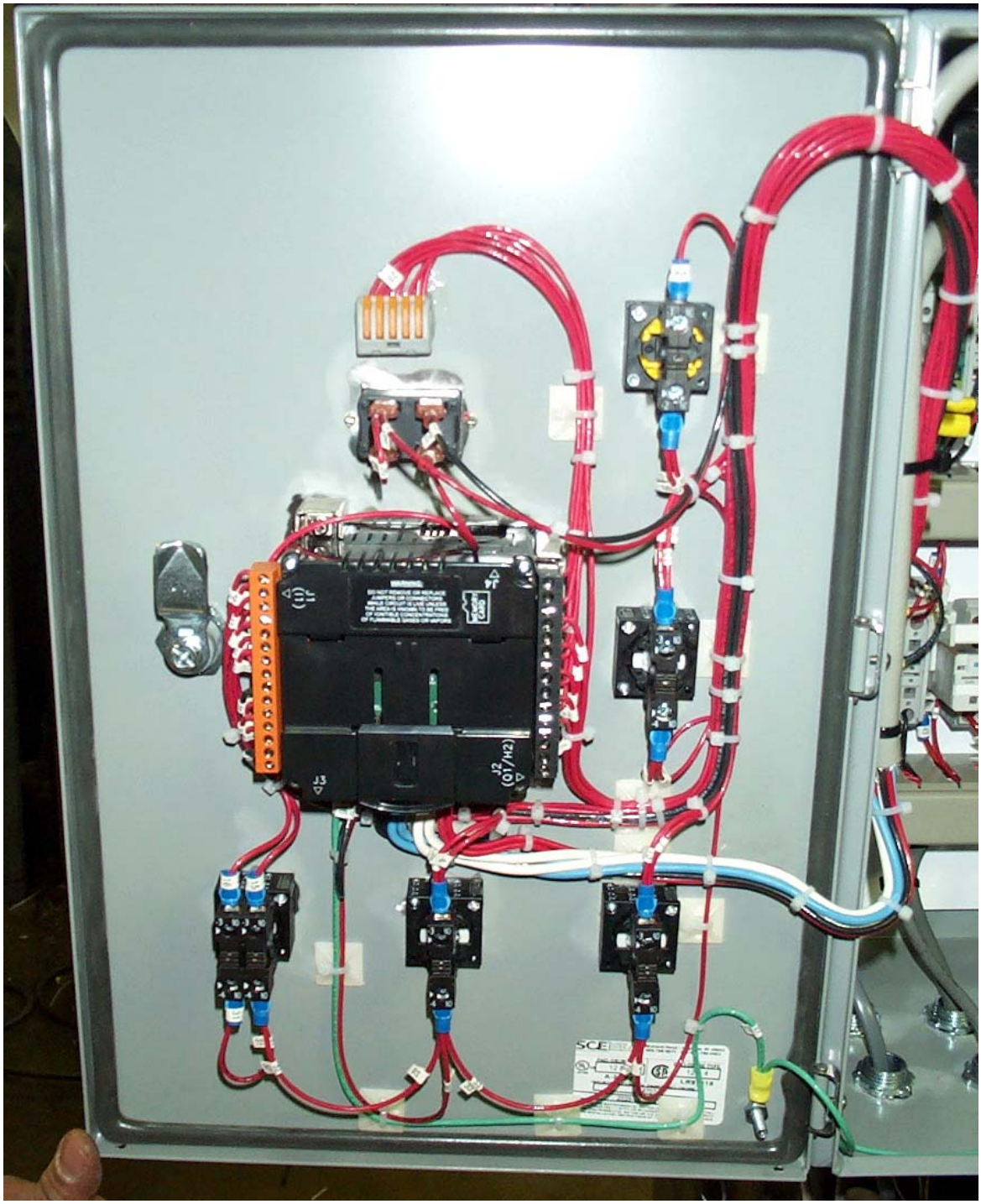
MAIN CONTROL PANEL – Showing controls for Raise, Lower, Park, Single/All/Pair, and Emergency Stop. Battery Level Gauge and Lift Display also present.

Left Side of Control Box

Right Side of Control Box

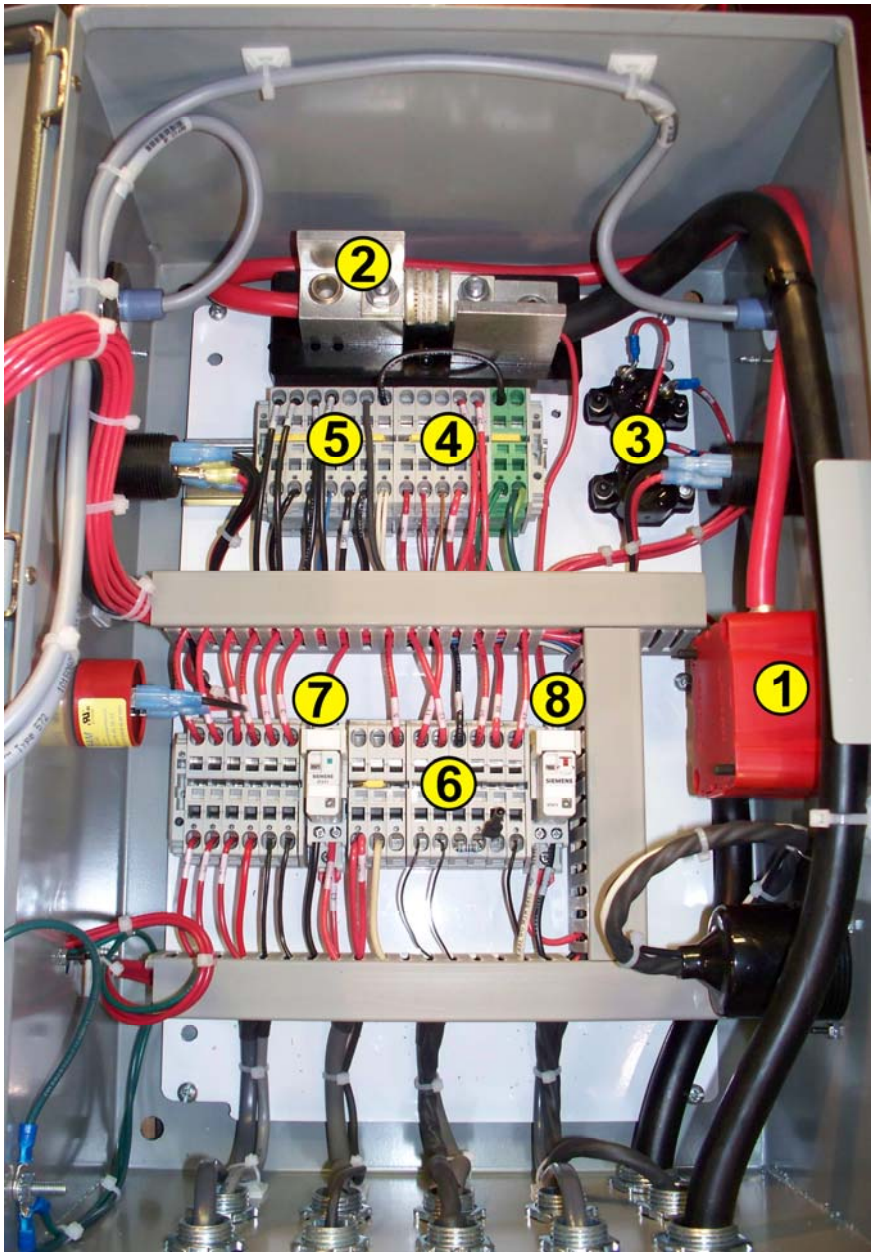
MASTER ENCLOSURE PORTS:

1. **COMMUNICATION RECEPTACLE** – Place where communication cable or dummy plug connects.
2. **12 VDC AUXILIARY POWER RECEPTACLE** – Provided to plug in standard electrical items that run on 12 VDC, (i.e. Lights)
3. **HORN** – Sounds when mechanical locks are released. Volume is adjustable.
4. **PENDANT RECEPTACLE** – Place where hand pendent connects.
5. **COMMUNICATION RECEPTACLE CAP** – Can also be used to hold spare dummy plugs.
6. **OPERATE LIFT/CHARGE LIFT SWITCH** – Turns on Power to post. When post power is turned off, charging is enabled.
7. **120 VAC CHARGER POWER INLET** – Connecting a 120 VAC Power Cord to this inlet provides power to the dual battery charger.



MASTER ENCLOSURE COMPONENTS (DOOR):

PLC (Programmable Logic Controller) – "Computer" that provides logic to the entire system, controlling all inputs and outputs, and networking with all other posts in the system. The orange strip is all the Inputs and the black strip is all the outputs. Communications are branched off the bottom of the PLC to both sides of the box to allow connectivity to other PLC's in the system.



MASTER ENCLOSURE COMPONENTS (PANEL):

1. **MAIN POWER SWITCH** – Turns on Power to the post.
2. **MAIN POWER FUSE** – 200 Amp rated to protect the whole electrical system, and sized to accommodate the motor amperage.
3. **CONTROL CIRCUIT BREAKERS** – One protects the PLC and the raising/lowering solenoids. A separate breaker protects the Lock Solenoid.
4. **24 VDC (+) TERMINAL BLOCKS** – Provide distribution for the +24 VDC.
5. **24 VDC (-) TERMINAL BLOCKS** – Provide distribution for the -24 VDC.
6. **INPUT/OUTPUT TERMINAL BLOCKS** – Provide distribution to several inputs and outputs.
7. **LOCK RELEASE RELAY (24 VDC)** – When energized, will divert power to lock release solenoid.
8. **CHARGER RELAY (120 VAC)** – Energizes when charger is supplied power (120 VAC) and prevents lift from running when lift is charging.

COMMUNICATION CABLE:

This is a DEVICENET network cable that is 10 meters long (32’-10” Long) with male ends. This cable is readily available from a variety of electrical suppliers that deal in network components.

DUMMY PLUGS:

Place male dummy plugs into opposite ends of post system at unused communication ports.

⚠ WARNING

Clear area if vehicle is in danger of falling.

©

⚠ WARNING

Remain clear of lift when raising or lowering vehicle.

©

⚠ WARNING

Locate lift on firm, level surface, preferably concrete.

©

⚠ WARNING

Be sure intended lifts are moving together evenly.

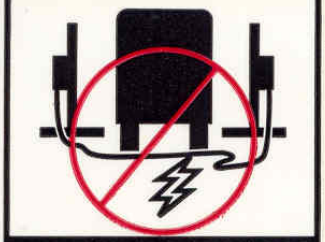
©

⚠ WARNING

All lifting forks must properly engage vehicle tires or supports.

©

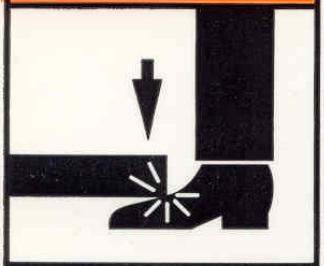
⚠ WARNING



Do not drive over or pinch electrical cables.

©

⚠ WARNING



Keep feet clear of lift while lowering.

©

The messages and pictographs shown are generic in nature and are meant to generally represent hazards common to all automotive lifts regardless of specific style.

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ALI/WL400w

⚠ CAUTION

Lift to be used by trained operator only. ©

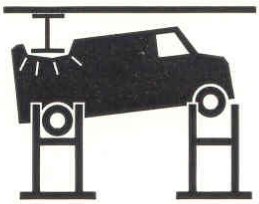
⚠ CAUTION

Authorized personnel only in lift area. ©

⚠ CAUTION

When moving lift, be careful to avoid tipping. ©

⚠ CAUTION



Check for overhead obstructions before raising vehicle. ©

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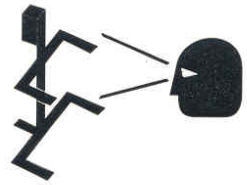
SAFETY INSTRUCTIONS

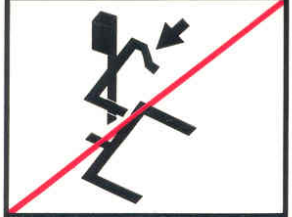
Read operating and safety manuals before using lift. ©

SAFETY INSTRUCTIONS



Proper maintenance and inspection is necessary for safe operation. ©

SAFETY INSTRUCTIONS



Do not operate a damaged lift. ©

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MOHAWK

SCHEMATICS

MP-18-24VDC-SERIES

ELECTRIC/HYDRAULIC
PORTABLE LIFT

#	DESCRIPTION	DATE	APPROVED
E	VIEW CHANGED TO REFLECT MINN KOTA BATTERY CHARGER	08/02/2011	G.GORE

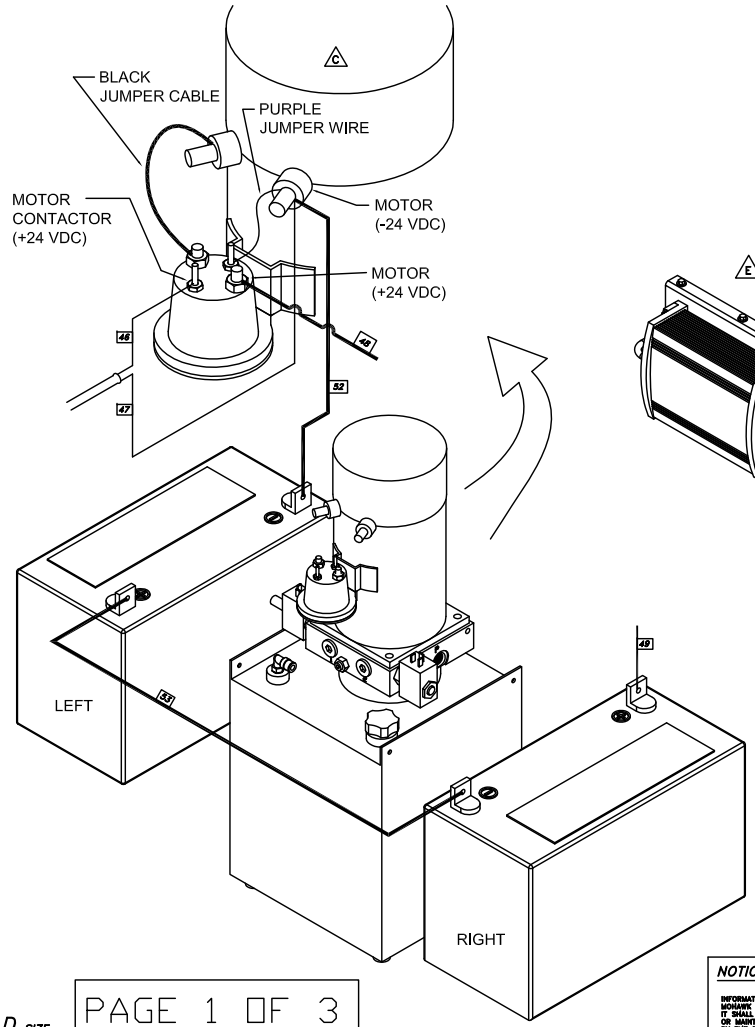
#	DESCRIPTION	DATE	APPROVED
C	150A C/B Replaced, Others moved Motor View Changed	08/19/2008	rwv7089
D	Wire Labels #60–#66 Added	05/21/2009	rwv7089

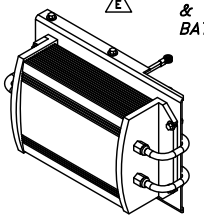
#	DESCRIPTION	DATE	APPROVED
B	Wiring Revised	10/08/07	dak0879

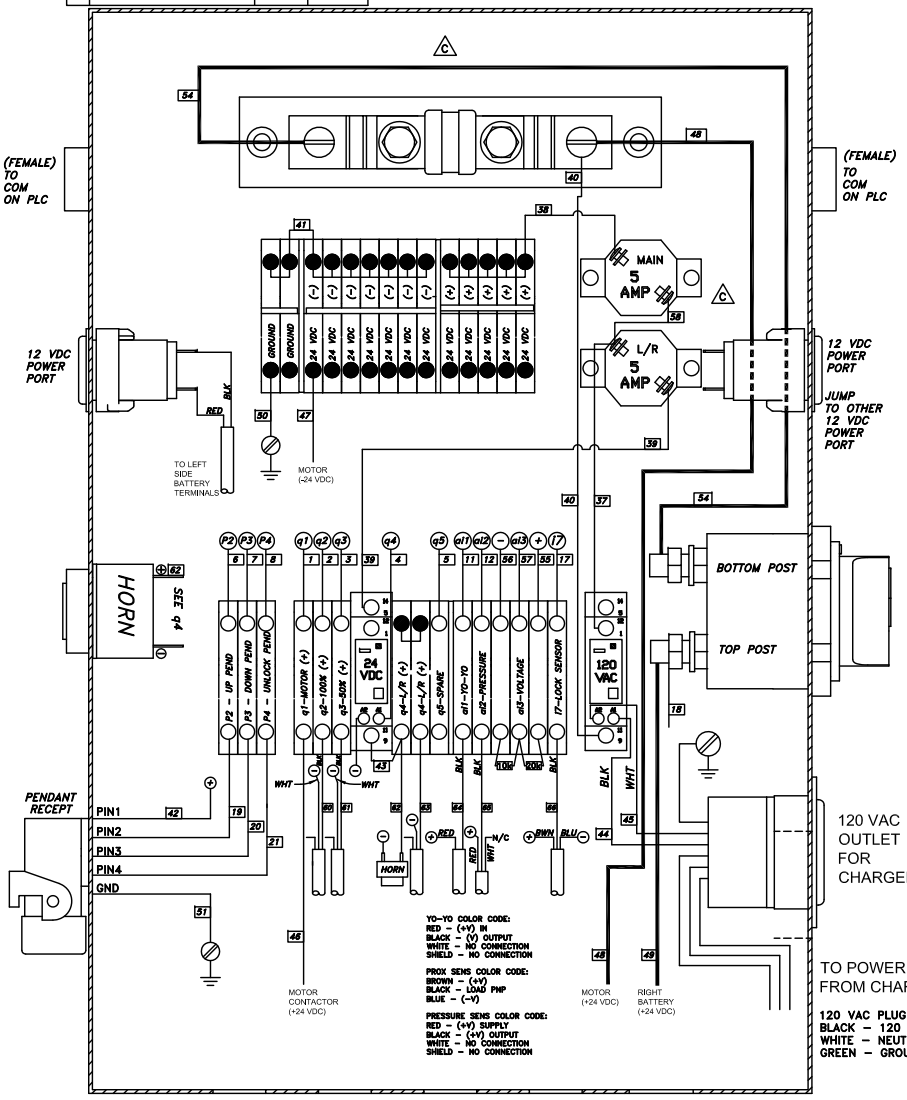
#	DESCRIPTION	DATE	APPROVED
A	Circuit Breaker Mods & Charger Wiring of Yo-Yo & Pressure Revised	07/03/2007	rwv7089

KEY:

- RED WIRES
  - – 24 VDC (ALL 16 GA MAX) (+)
  - – 24 VDC (ALL 16 GA MAX) (+) CONDITIONAL OUTPUTS
  - – 24 VDC (ALL 16 GA MAX) (+) CONDITIONAL INPUTS
- BLACK WIRES – 24 VDC (ALL 16 GA MAX) (–)
  - – DEVICE NET COM
- GREEN WIRES – GROUND







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1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
XX ± .030
XXX ± .005

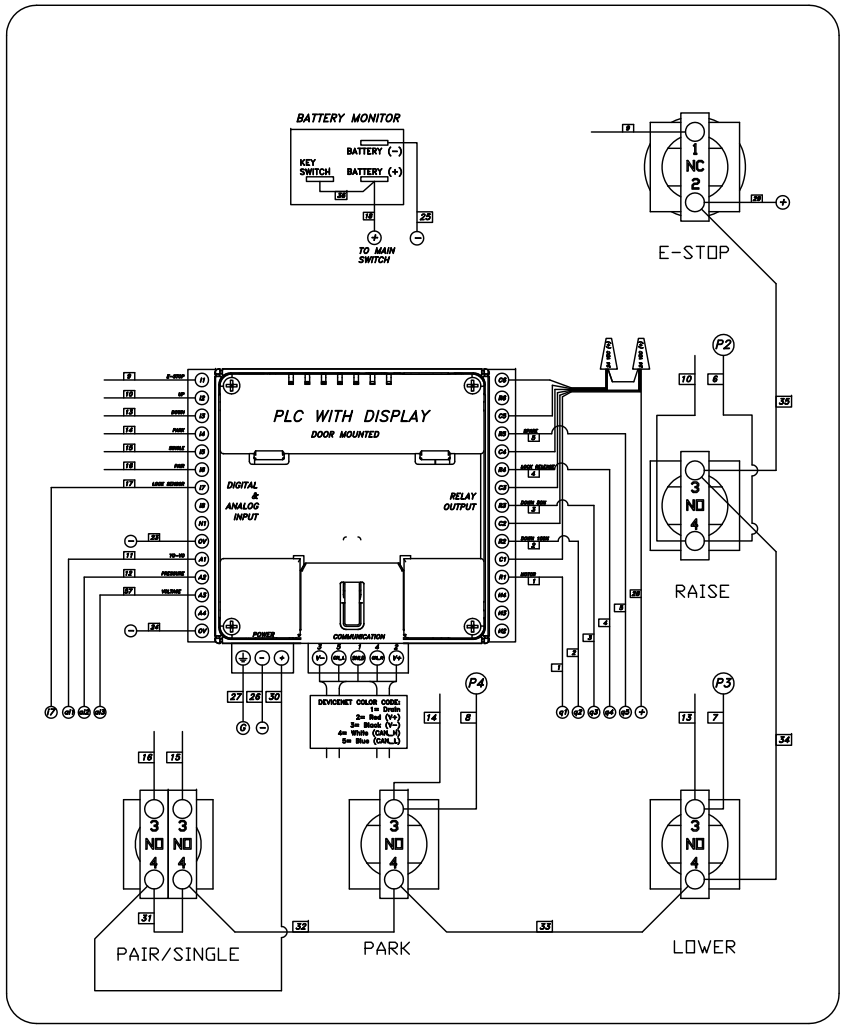
FILE NAME: MP-5000-A-001

MP-51

NEXT ASSEMBLY

SCALE	DRAWN	MOHAWK RESOURCES LTD.
1/2	rwv7089	
CHECKED	APPROVED	TITLE: MP-24VDC-SERIES Master Box Assy
DATE: 11/30/06	WEIGHT: 30 LB.	FROM: n/a
		DRAWING NUMBER: MP-5000-A-001 E

D-SIZE



PANEL WIRING

PNP–SOURCING–POSITIVE LOGIC WIRING

D-SIZE

PAGE 2 OF 3

NOTICE OF CONFIDENTIAL INFORMATION

INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPERTY OF MOHAWK RESOURCES LTD.. WHERE DRAWING IS FURNISHED TO OTHERS IT SHALL BE USED SOLELY FOR PURPOSES OF INSPECTION, INSTALLATION, OR MAINTENANCE. THE INFORMATION SHALL NOT BE USED OR DISCLOSED BY THE RECIPIENT FOR ANY OTHER PURPOSES WHATSOEVER.

NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

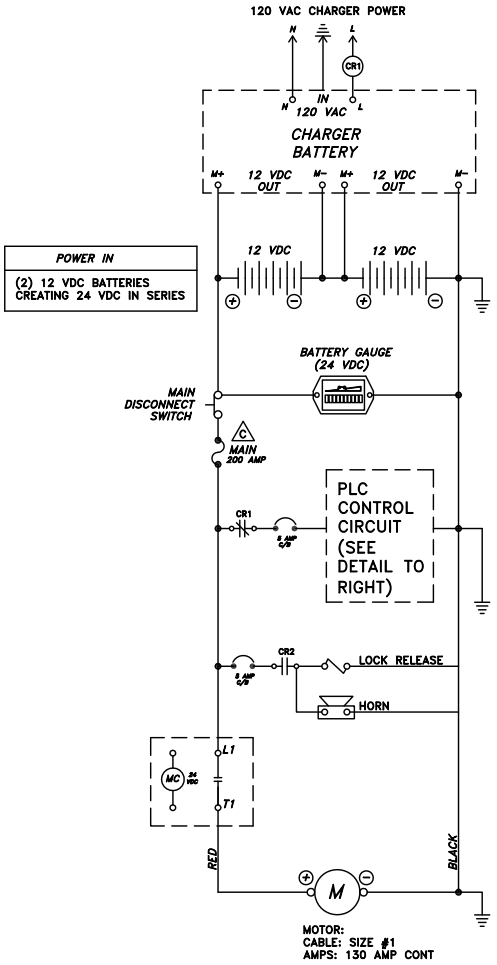
TOLERANCES:
ANGULAR ± 1.°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

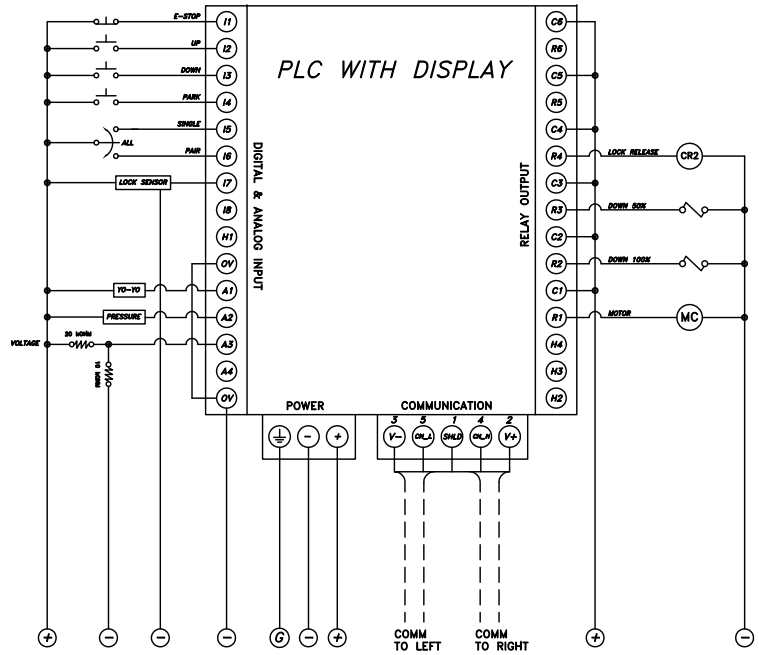
FILE NAME: MP-5000-A-001

MP-51

NEXT ASSEMBLY

SCALE 1/2	DRAWN rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE MP-24VDC-SERIES Master Box Assy	
DATE 11/30/06	WEIGHT 30 LB.	FROM n/a	DRAWING NUMBER MP-5000-A-001 E





MP-SERIES (24 VDC)

NOTICE OF CONFIDENTIAL INFORMATION

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NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-5100-A-001

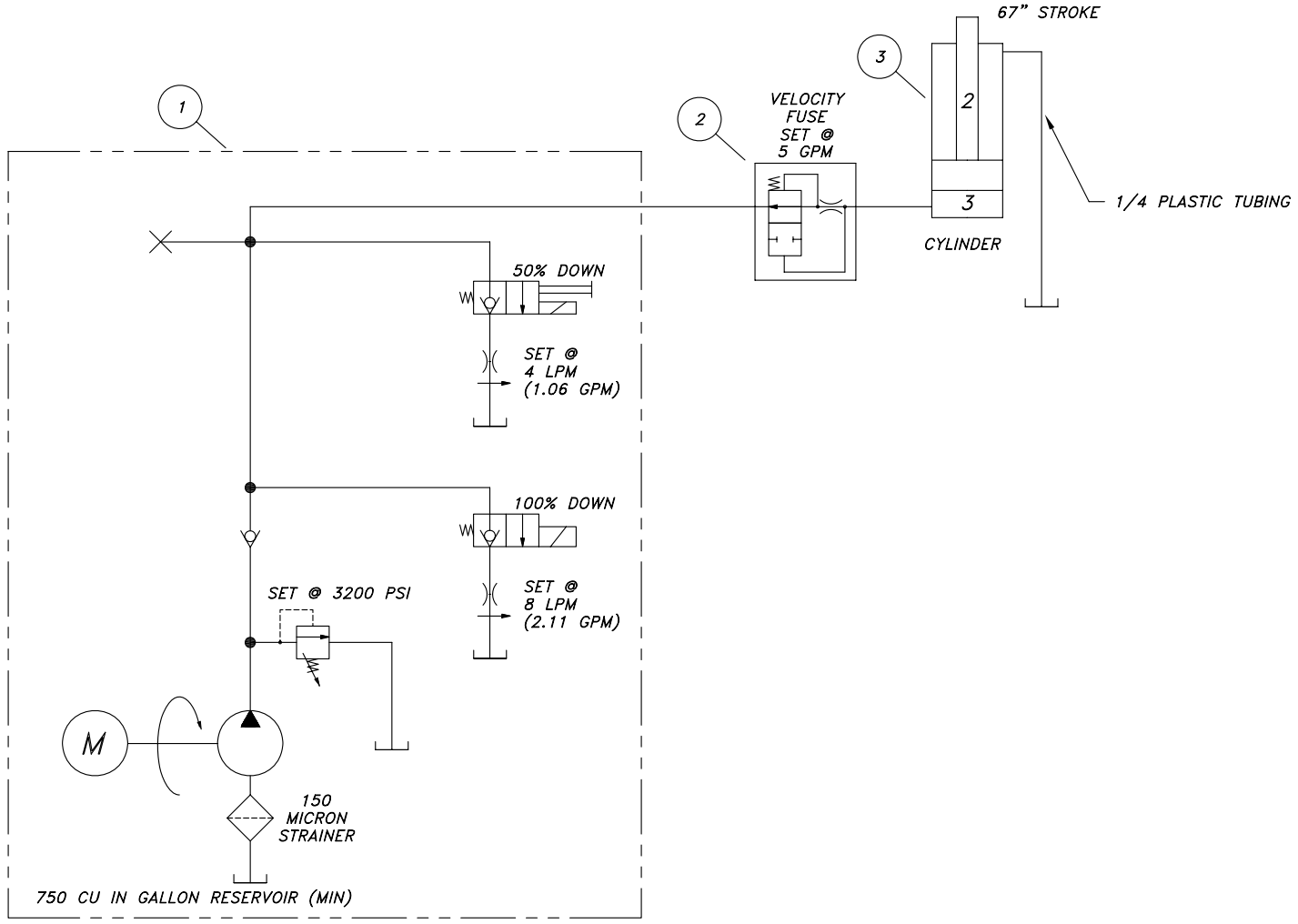
MP-51

NEXT ASSEMBLY

SCALE 1/2	DRAWN rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE MP-24VDC-SERIES Master Box Assy	
DATE 11/30/06	WEIGHT 30 LB.	FROM n/a	DRAWING NUMBER MP-5000-A-001 E

D-SIZE

#	DESCRIPTION	DATE	APPROVED
A	Item 1 was 601-300-088	08/19/2008	rwv7089



ITEM	NAME	DESCRIPTION	QTY
3	MP-0900-P-001	Cylinder Assembly (Purchased), 3" x 67"	1
2	601-410-073	Velocity Fuse, 5 GPM	1
1	601-300-095	Power Unit, 24 VDC	1

Parts List

C-SIZE

NOTICE OF CONFIDENTIAL INFORMATION

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NOTES:
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2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70TI CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1 °
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME MP-5000-A-002

MP-0000-A-

NEXT ASSEMBLY

SCALE

DRAWN rwv7089

CHECKED

APPROVED

DATE 4/07

WEIGHT n/a LB.

MOHAWK RESOURCES LTD.

TITLE MP-18 (24 VDC) Hydraulic Schematic

FROM n/a

DRAWING NUMBER MP-5000-A-002

A

MOHAWK

CHARGER INFORMATION

MP-18-24VDC-SERIES

ELECTRIC/HYDRAULIC
PORTABLE LIFT

Anywhere. Anytime.

OWNER'S MANUAL FOR MINN KOTA ONBOARD BATTERY CHARGERS
Models: MK110D,MK210D, MK220D, MK315D, MK330D

MARINE
C UL US
LISTED

Service Information:
Please call our service department at 800-227-6433 if you have any problems with your battery charger. A technical support representative will be happy to assist you.

FC

Compliant with FCC PART 15,Class B

1. SAFETY INFORMATION

IMPORTANT SAFETY INSTRUCTIONS
SAVE THESE INSTRUCTIONS!

This manual contains important safety and operating instructions applicable to the safe and efficient use of your Minn Kota battery charger.

The Minn Kota battery charger is a powerful electrical device. If incorrectly installed, configured or operated, the battery charger can damage batteries and / or electrical equipment. Please read thoroughly the instructions and safety information contained in this manual before operating the battery charger.

WARNING: RISK OF EXPLOSIVE GASES

WORKING IN THE VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES CONTAIN SULFURIC ACID AND PRODUCE EXPLOSIVE GASES. A BATTERY EXPLOSION COULD RESULT IN LOSS OF EYESIGHT OR SERIOUS BURNS. FOR THIS REASON, IT IS OF UTMOST IMPORTANCE THAT YOU FOLLOW THE INSTRUCTIONS EACH TIME YOU USE THE CHARGER.

TO REDUCE THE RISK OF BATTERY EXPLOSION, FOLLOW THESE INSTRUCTIONS AND THOSE PUBLISHED BY THE BATTERY MANUFACTURER FOR ANY EQUIPMENT YOU INTEND TO USE IN THE VICINITY OF THE BATTERY. REVIEW CAUTIONARY MARKINGS ON THESE PRODUCTS AND ON ENGINE, MOTOR OR OTHER EQUIPMENT REQUIRING BATTERY USAGE.

Use of an attachment not recommended or sold by Johnson Outdoors Inc. may result in risk of fire, electric shock, or injury to persons or property.

The charger is not intended for use by young children or infirm persons without supervision. Young children should be supervised to ensure that they do not play with the charger.

To reduce risk of damage to electric plug or cord, pull by the plug rather than the cord when disconnecting the battery charger.

An extension cord should not be used unless absolutely necessary. Use of the improper extension cord could result in a risk of fire or electric shock. If extension cord must be used, make sure:

a) That pins of plug of the extension cord are the same number, size and shape of those of the plug on the battery charger;

b) That extension cord is properly wired and in good electrical condition;

c) That wire in extension cord is proper size as follows:

Minimum recommended AWG wire size for various length extension cords used with the Minn Kota battery charger:

Length of Cord in feet	25	50	100
AWG Size	16	14	12

Do not operate the battery charger with a damaged cord or plug.

Do not operate the battery charger if it has received a sharp blow, been dropped or otherwise damaged in any way.

Do not disassemble the charger. Incorrect reassembly may result in a risk of electric shock or fire.

To reduce risk of electric shock, unplug the charger from outlet before attempting any maintenance or cleaning. Disconnecting the leads will not reduce this risk.

To reduce to risk of shock or spark, never touch the ring terminals together while the charger is plugged into an outlet or extension cord.

External connections to the battery charger shall comply with the United States Coast Guard electrical regulations (33CFR183, Sub Part 1).

2. PERSONAL PRECAUTIONS

Consider having someone close enough nearby to come to your aid when you work near a lead acid battery.

Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes.

Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.

If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 10 minutes and get medical attention immediately.

Never smoke or allow a spark or flame in vicinity of battery, engine, motor or other flammable or explosive equipment.

Be extra cautious to reduce risk of dropping a metal tool onto battery. It might spark or short circuit battery or other electrical part that may cause explosion.

Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead acid battery. A lead acid battery can produce a short circuit current high enough to weld such items, causing severe burns.

Use the Minn Kota battery charger for charging and maintaining FLOODED / WET CELL, MAINTENANCE FREE, AND AGM / STARVED ELECTROLYTE batteries only. It is not intended to supply power to low voltage electrical systems other than for charging and maintaining batteries. Do not use the charger for charging dry-cell batteries that are commonly used with home appliances. These batteries may burst and cause injury to persons and damage to property.

NEVER charge a frozen battery.

3. PREPARING TO CHARGE

1) If necessary to remove battery from boat or vehicle to charge or maintain, always remove grounded terminal from battery first (if applicable). Make sure all accessories in the boat or vehicle are off, so as not to cause an arc.

2) Be sure area around battery is well ventilated while battery is being charged or maintained.

3) Clean battery terminals. Be careful to keep corrosion from coming in contact with eyes.

4) Add distilled water in each cell until battery acid reaches level specified by battery manufacturer ONLY AFTER the battery has been charged. Adding water to a discharged battery may result in acid leaking out of the battery and causing injury to persons and damage to property. Do not overfill. Study all battery manufacturers' specific precautions; however, make sure to REPLACE ALL CELL CAPS after refilling so that water evaporation is avoided. Water will evaporate over time if cell caps are not replaced after refilling. For a battery without removable cell caps, such as valve regulated lead acid batteries, carefully follow manufacturer's recharging instructions.
NOTE: The battery fluid level should be checked every 30 days

5) Study all battery manufacturers' specific precautions while charging and recommended rates of charge.

4. DC CONNECTION PRECAUTIONS

1) The Minn Kota charger will only charge 12 volt 6 cell lead acid batteries. Do not connect the output of the charger to any other voltage or type of battery.

2) The charger's DC output terminals are designed to be permanently mounted and connected to batteries.

3) Connect and disconnect DC output terminals only after removing the AC plug from the electric outlet.

4) The charger output leads must be connected with the correct polarity for the charger to function. The RED lead must be connected to the POSITIVE terminal of the battery and the BLACK lead must be connected to the NEGATIVE terminal of the battery. **See section 6 under "CONNECTING THE BATTERIES TO THE CHARGER" for proper connection procedure.**

5. GROUNDING AND AC POWER CORD CONNECTION INSTRUCTIONS

The Minn Kota battery charger should be grounded to reduce risk of electric shock. The charger is equipped with an electric AC power cord with a grounded plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

DANGER – Never alter AC cord or plug provided – if it will not fit outlet, have proper outlet installed by a qualified electrician. Improper connection can result in a risk of an electric shock.

CAUTION – To reduce risk of fire or electric shock, connect battery charger directly to grounding receptacle (three-prong). An adapter should not be used with battery charger.

6. INSTALLING THE BATTERY CHARGER

CHOOSING THE MOUNTING LOCATION:
For optimum performance, the charger should be mounted flush on a bulkhead in a protected area away from rain or spray. Do not mount the charger above batteries as lead-acid batteries give off corrosive gasses which will damage the charger over time. Never allow battery acid to drip on charger when reading electrolyte specific gravity or filling battery. Also, as with most electrical devices, do not mount the charger below the waterline of the boat or directly adjacent to fuel tanks.

Each DC output cord is 6 feet long. Make sure that all DC output cords can reach the batteries and that the AC power cord can reach a power source. When using an extension cord, make the AC connection to the charger outside of the battery compartment as far away as practical to reduce the risk of a spark igniting gasses in the compartment.

Each output cord is equipped with a temperature sensor. By monitoring external temperature, the battery charger adjusts the charging profile of the battery to assure full charge without overcharging or undercharging the battery. Attempting to lengthen or shorten the output wires could damage the temperature sensor and affect the charger output.

If the DC battery leads are not long enough, they may be lengthened by splicing and soldering 12 AWG (minimum) wire. Each splice should be covered with dual wall adhesive lined heat shrink tubing to protect the joint from corroding. The splice should be made between the fork in the output cable and the fuse holder. The fuse holder should always remain within 7" of the battery terminals. The maximum extension length is 15 feet. You may contact the Minn Kota Service Department with any questions. Do not splice the AC power cord, as this voids the three year Limited Warranty.

Even though the Minn Kota charger is capable of operating in a high ambient temperature environment, a minimum of 6 inches of unobstructed area should be allowed on all sides of the unit for proper air circulation and cooling. Proper cooling and circulation will allow the charger to operate at peak efficiency.

MOUNTING THE CHARGER:
Due to the weight of the charger and the pounding that boats routinely endure, take the time to securely mount the charger to prevent damage. Mounting with bolts, nuts, and washers is preferable to mounting with screws. Use the largest diameter bolts possible, and use all four mounting holes.

Your battery charger is supplied with an AC plug holder designed to hold the power cord plug when not in use. Mount the AC plug holder with four screws in a convenient dry site to prevent corrosion to the AC plug and to prevent the AC plug from making contact with the battery posts.

CAUTION – Because the body of the battery charger is metallic, do not directly mount the charger to the hull of an aluminum boat. Use a means of isolation (such as wood or plastic) to prevent the charger body as well as mounting fasteners from coming in contact with the aluminum boat structure or hull. Doing so will eliminate any risk of electrolysis that may occur when AC power is connected to the charger.

WARNING – MAKE SURE THE CHARGER IS DISCONNECTED FROM AC POWER BEFORE CONNECTING THE BATTERIES TO THE OUTPUT CORDS.

CAUTION - Before making any connections to batteries in a confined space (such as a battery compartment of a boat), open the door or hatch of the compartment and allow it to air out for 15 minutes. This allows any gasses that have accumulated in the compartment to escape.

CONNECTING THE BATTERIES TO THE CHARGER:
FOLLOW THESE STEPS WHEN THE BATTERY CHARGER IS *INSTALLED IN A BOAT OR VEHICLE*. A SPARK NEAR THE BATTERY MAY CAUSE BATTERY EXPLOSION. TO REDUCE THE RISK OF A SPARK NEAR THE BATTERY:

1. Position AC and DC cords to reduce risk of damage by hood, door, or moving engine parts.

2. Stay clear of fan blades, belts, pulleys and other parts that can cause injury to persons.

3. Check polarity of battery posts. POSITIVE (POS, P, +) battery post is usually larger in diameter than NEGATIVE (NEG, N, -) post.

4. Determine which post of the battery is grounded (connected) to the chassis (if any). If negative post is grounded to the boat hull or chassis (as in most vehicles), see (5) below. If positive post is grounded to the boat hull or chassis, see (6) below. If neither is grounded, the order in which the output leads are connected does not matter.

5. For negative-grounded boat or vehicle, connect POSITIVE (RED) output terminal to POSITIVE (POS, P, +) ungrounded post of battery first. Then connect NEGATIVE (BLACK) output to NEGATIVE (NEG, N, -) grounded post of battery.

6. For positive-grounded boat or vehicle, connect NEGATIVE (BLACK) output to NEGATIVE (NEG, N, -) ungrounded post of battery first. Then, connect POSITIVE (RED) output terminal to POSITIVE (POS, P, +) grounded post of battery.

7. When disconnecting charger, disconnect AC power cord from electric outlet first.

8. When disconnecting output terminals from battery posts, always do so in reverse sequence of the connecting procedure while as far away from battery as practical.

FOLLOW THESE STEPS WHEN BATTERY IS *OUTSIDE BOAT OR VEHICLE*. A SPARK NEAR BATTERY MAY CAUSE BATTERY EXPLOSION. TO REDUCE THE RISK OF A SPARK NEAR BATTERY:

1. Check polarity of battery posts. POSITIVE (POS, P, +) battery post is usually larger in diameter than NEGATIVE (NEG, N, -) post.

2. Connect POSITIVE (RED) output terminal to POSITIVE (POS, P, +) post of battery.

3. Connect NEGATIVE (BLACK) output terminal to NEGATIVE (NEG, N, -) post of battery.

4. Do not face battery when making final connection.

5. When disconnecting charger, disconnect AC power cord from electric outlet first.

6. When disconnecting output terminals from battery posts, always do so in reverse sequence of the connecting procedure while as far away from battery as practical.

7. A marine (boat) battery does not need to be removed and charged on shore. However, instructions must be followed for location of charger when permanently mounted or used on board.

Each output bank is independent and isolated from one another and the AC input. The Minn Kota charger can charge independent batteries or combinations of batteries hooked in series or parallel without disconnecting the batteries from any switches or wires / straps joining the batteries. See diagram on page 8.

7. OPERATING INSTRUCTIONS

Make sure the charger is properly mounted and the DC output cords are connected properly to the batteries. Double check the polarities of the output cords and make sure the correct bank of the charger is connected to the correct battery.

INDICATOR LIGHTS:
To begin charging, connect the charger to AC power. All lights will turn on momentarily. The following will be displayed on the charger:

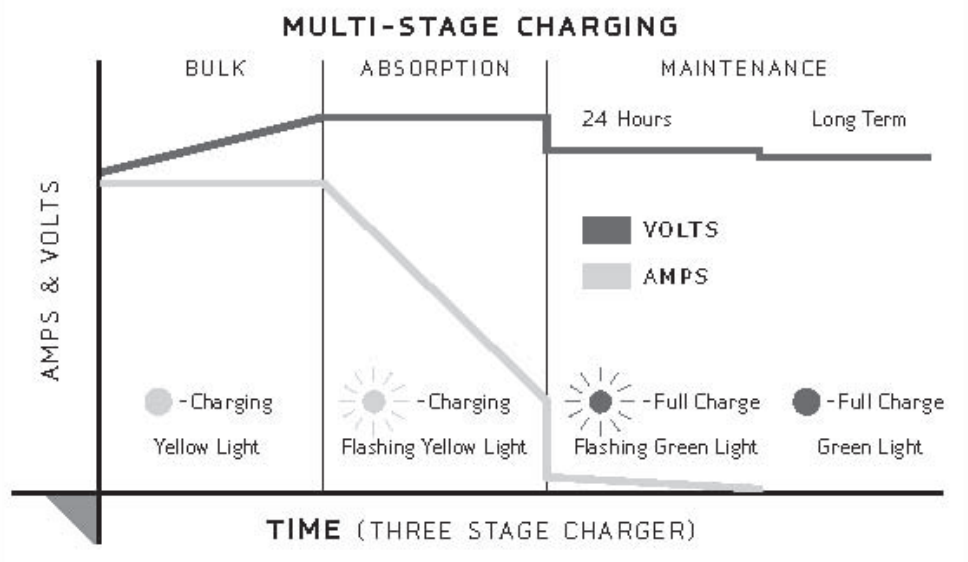
A GREEN power light is lit to indicate AC power is applied. Each bank has YELLOW, GREEN, and RED lights to indicate charging status and error conditions.

Minn Kota's Multi-Stage Charging has three modes of operation that deliver a fast, precise charge profile by automatically controlling current and voltage without overcharging your batteries.

Stage 1: Bulk Mode
During this stage, the charger delivers full current until the battery reaches ~75% charge. A YELLOW light is lit for each bank to indi cate the battery is charging in the Bulk Mode.

Stage 2: Absorption Mode
The charging current tapers down while the battery voltage is held at 14.4V at 77°F. A flashing YELLOW light is lit for each bank to indicate the battery is charging in the Absorption Mode.

Stage 3: Maintenance Mode
When the battery reaches full charge, the charger voltage is dropped to 13.4V at 77°F. A flashing GREEN light is lit for each bank to indicate the battery is in Maintenance Mode and ready to use. After 24 hours, the charger automatically turns off and a GREEN light is lit for each bank to indicate the battery is in long term Maintenance Mode and ready to use. The charger will automatically turn on when the battery voltage drops below 12.6V.



Error Conditions:

1) A **RED** light for each bank is lit if any of the following apply:

a) No battery is connected to an output cord. This may also indicate a blown fuse in the fuse holder.
b) The battery is connected reverse polarity.
c) A short circuit.
d) The battery voltage is below 4 volts. The bank will not charge a battery in this condition. (see note below)
e) The battery voltage is above 18 volts. The bank will not charge a battery in this condition.

2) A flashing **RED** light is lit for each bank if there is a damaged temperature sensor on the output cord. The bank will not operate if this occurs.

3) Flashing **RED** and **GREEN** lights are lit for each bank if any of the following apply:

a) The battery voltage does not rise above 10.5V after 3 hours. The battery may be damaged and will not be charged.
b) Charging in Bulk Mode exceeds 20 hours. The battery may be damaged and will not be charged

NOTE – A 12 volt battery with an open-circuit voltage below 4 volts has either been discharged to the point of internal damage, may be heavily sulfated, or may have internal shorted cells. Attempting to charge a battery in this state is dangerous. The battery should be replaced.

CAUTION – If a RED light is lit, disconnect the AC power from the charger immediately. Determine the reason based on the above information and take the necessary corrective action to remedy the situation. If you are unable to remedy the situation and need help, call the Minn Kota Service Department at 1-800-227-6433 and a technical support representative will be happy to assist you.

CAUTION – We recommend that you not recharge your battery, (or batteries), with the watercraft or motor lower unit in the water during electrical storms. Severe damage to the motor or charging system may occur if lightning strikes nearby or if storm related high voltage conditions exist.

CAUTION – Generators with a modified square wave output can damage this MINN KOTA charger. Generators with a sine wave output can be used to power this charger.

WARNING – TO REDUCE RISK OF ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THOSE CONTAINED IN THE OPERATING INSTRUCTIONS.

INLINE FUSE:
Each output cord has inline fuses on the RED and BLACK leads located near the ring terminals. These fuses serve as protection from surges and short circuits caused by a damaged charger output cable. If a fuse blows, replace it with the exact type and rating of the original fuse. Improper battery connections will normally not cause a fuse to blow since this is handled by the chargers internal circuitry.

8. MAINTENANCE / CLEANING / STORAGE INSTRUCTIONS

Check battery charger for dirt, oil, battery corrosion, etc. Use a water and baking soda solution for cleaning corrosion. Wipe clean using a dry cloth.

Check ring terminals for dirt, oil, and battery corrosion; then disconnect from battery posts and clean as necessary with water and baking soda solution and dry with a clean cloth.

When the charger is not in use, coil the power cord to prevent damage.

If power cord or plug becomes damaged, you may contact the Minn Kota Service Repair Department for service repair information. Otherwise, dispose of the battery charger in compliance with local law. Damaged cords and plugs can cause electric shock or electrocution.

When storing the battery charger, store in a clean dry area.

NOTE – This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver.
Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.

CAUTION – Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

9. TROUBLESHOOTING

PROBLEM:
Check Connection (Red) light comes on.

SOLUTION:
-Check polarity of leads to battery.
-Check connetions to battery and fuses in output cord.
-Check voltage at battery. The bank will not charge a battery below 4 volts or above 18 volts.
-If still not working, call the Minn Kota Service Department at 1-800-227-6433.

PROBLEM:
Check Connection (Red) light is flashing.

SOLUTION:
-The temperature sensor in the output cord is damaged. Check to make sure the output cord is not damaged. If the output cord was extended, check to make sure the procedure in Section 6 was followed.
-If still not working, call the Minn Kota Service Department at 1-800-227-6433.

PROBLEM:
Indicator lights will not illuminate.

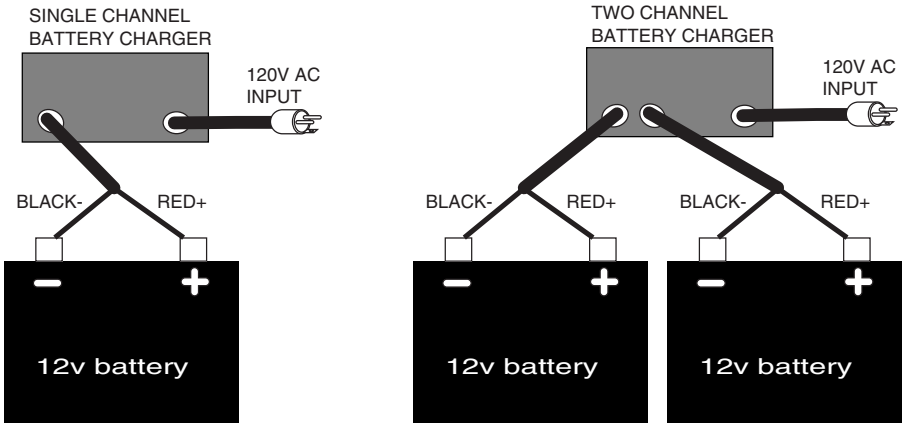
SOLUTION:
-Check the AC power at the outlet.
-Make sure the GFCI(Ground Fault Circuit Interrupter) o the outlet has not tripped.
-Check the AC power at the end of the extension cord.
-If still not working, call the Minn Kota Service Department at 1-800-227-6433.

PROBLEM:
The red and green lights are flashing.

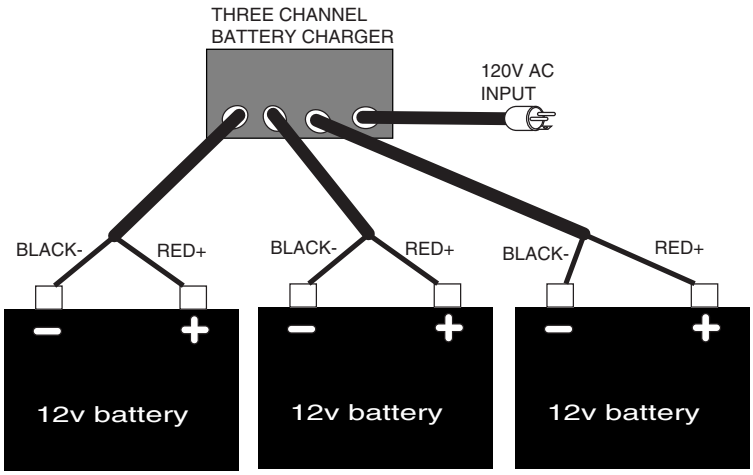
SOLUTION:
-Check to make sure there are not any loads on the battery
-Check the fluid in the battery and add fluid if necessary.
-If the voltage of the battery does not increase above 10.5 volts after 3 hours or does not increase to the absorption voltage of 14.4 volts in 20 hours, then the bank will shut down and will not charge. The battery should be tested.
-If still not working, call the Minn Kota Service Department at 1-800-227-6433.

Specifications:

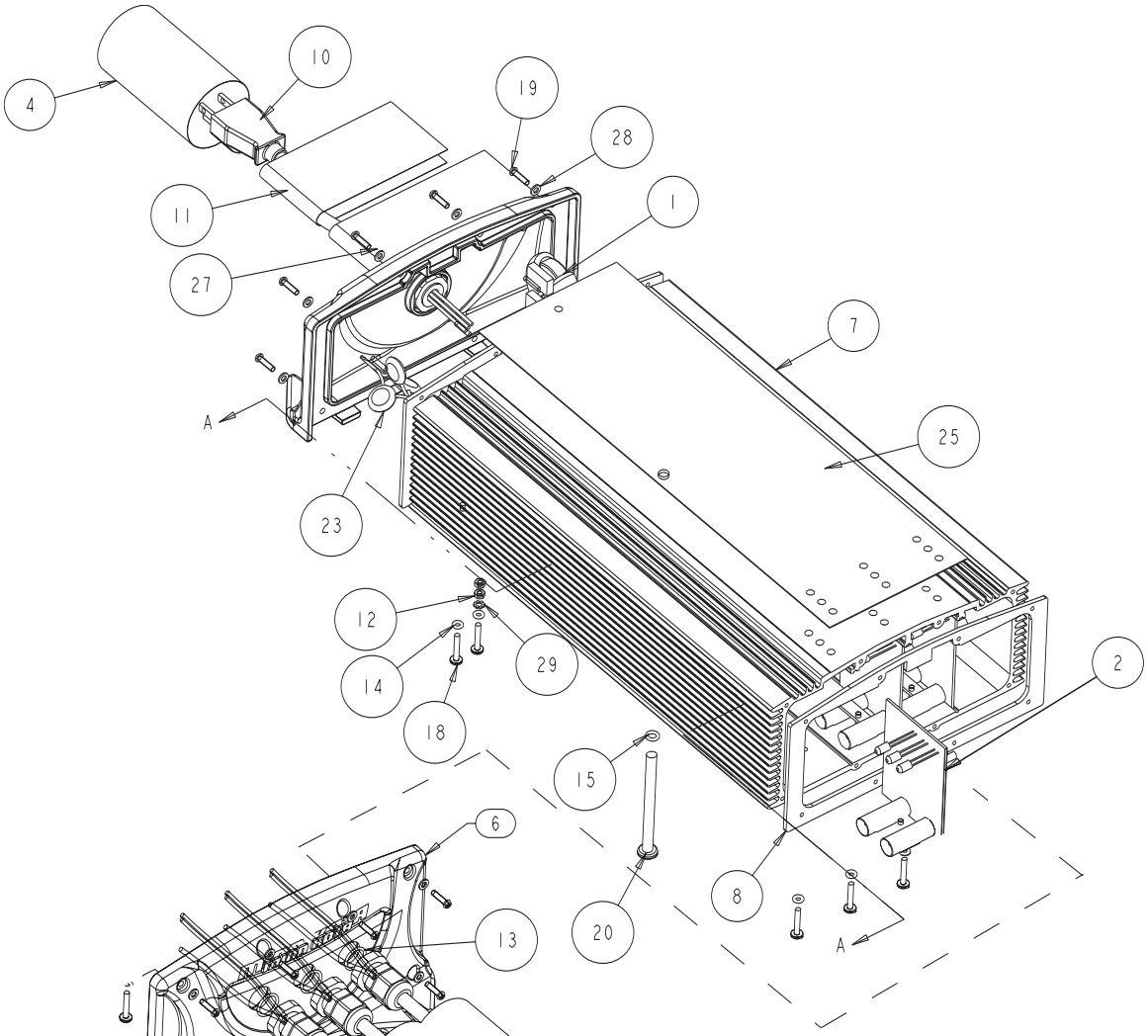
Model	Part No.	System Volts	Banks	Output per Bank (amps)	Total Output (amps)	Input Cable	Output Cable	Size L x W x H	Weight (lbs)	Input Current (120VAC, 60Hz)
MK110D	1821105	12	1	10	10	18AWG - 6'	16AWG - 6'	10-1/2" x 7-1/2" x 4"	10	2.5A
MK210D	1822105	12 / 24	2	5	10	18AWG - 6'	16AWG - 6'	11-1/2" x 7-1/2" x 4"	11	2.5A
MK220D	1822205	12 / 24	2	10	20	18AWG - 6'	16AWG - 6'	13-1/2" x 7-1/2" x 4"	15	4.4A
MK220DS	1822204	12 / 24	2	10	20	18AWG - 8.5'	16AWG - 6'	13-1/2" x 7-1/2" x 4"	15	4.4A
MK315D	1823155	12 / 24 / 36	3	5	15	18AWG - 6'	16AWG - 6'	12-1/2" x 7-1/2" x 4"	14	2.7A
MK330D	1823305	12 / 24 / 36	3	10	30	18AWG - 6'	16AWG - 6'	16-1/4" x 7-1/2" x 4"	20	5.2A
MK330DS	1823304	12 / 24 / 36	3	10	30	18AWG - 8.5'	16AWG - 6'	16-1/4" x 7-1/2" x 4"	20	5.2A

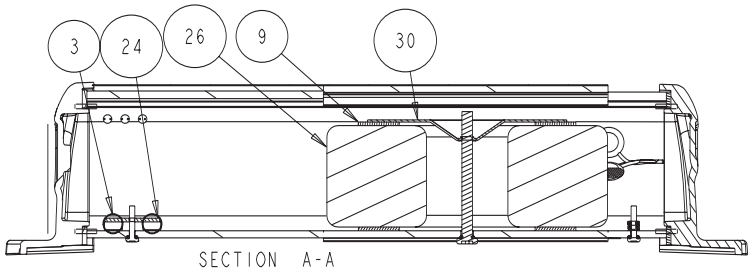


NOTE: If batteries are connected in series for 12/24 - 24V, the series connection wire should be left in place during charging.



NOTE: If batteries are connected in series for 12/24 - 24 - 24/36 - 36V, the series connection wire should be left in place during charging.





ITEM#	QTY.	PART NAME
1	1	AC FILTER
2	3	BOARD
3	6	BOOT, SILICONE
4	1	DECAL
5	1	DECAL, DATE CODE
6	2	ENDCAP
7	1	EXTRUSION
8	2	GASKET
9	2	GASKET, TRANSFORMER
10	1	INPUT CORD
11	1	INPUT WARNING LABEL
12	2	NUT, GROUND M3
13	4	O-RING, STRAIN RELIEF PG9
14	5	O-RING, T-BAR SCREW
15	1	O-RING, TRANSFORMER SCREW
16	3	OUTPUT CORD
17	3	OUTPUT CORD DECAL
18	5	SCREW
19	16	SCREW, M3
20	1	SCREW, TRANSFORMER M6
21	1	SERIAL NUMBER
22	4	STRAIN RELIEF, PG9
23	1	SURGE PROTECTOR
24	3	T-BAR
25	1	TOP DECAL
26	1	TRANSFORMER
27	1	WARNING LABEL
28	16	WASHER, 3MM
29	1	WASHER, LOCK M3
30	1	WASHER, TRANSFORMER

This page provides Minn Kota® WEEE compliance disassembly instructions. For more information about where you should dispose of your waste equipment for recycling and recovery and/or your European Union member state requirements, please contact your dealer or distributor from which your product was purchased.

Tools required but not limited to: Flat Head screw driver, Phillips screw driver, Socket set, Pliers, wire Cutters..

MOHAWK

BATTERY INFORMATION

MP-18-24VDC-SERIES

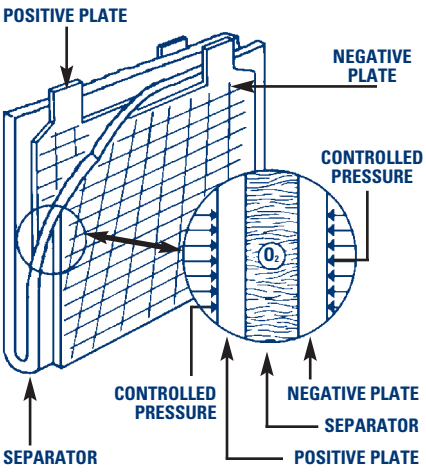
ELECTRIC/HYDRAULIC
PORTABLE LIFT

Deka AGM Series (Absorbed Glass Mat) for longer and safer battery operation

Deka's AGM (Absorbed Glass Mat) Series uses a special absorbed electrolyte technology that is superior to conventional lead-acid batteries. This completely sealed valve-regulated battery line eliminates gas emissions and acid leakage for longer and safer battery operation.

How AGM Works

Unlike conventional "flooded" lead-acid batteries, AGM sealed valve-regulated technology eliminates the need to add water because the oxygen and hydrogen gases react to maintain the necessary amounts of moisture. Highly porous microfiber separators wrapped around the positive plates completely absorb and trap the electrolyte, so there is no excess to spill or leak out of the battery. Oxygen formed from the positive plates during charging passes horizontally through the separator pores to the negative plates, where it reacts with hydrogen and changes back to water to replenish the electrolyte.



Oxygen diffuses through the horizontal separator pores to the negative plate as this is the only available path.

LEAD RETURN Pb RECYCLE

® UL Recognized Component MH17218

QUALITY SYSTEM CERTIFIED ISO 9001 ISO/TS 16949
ENVIRONMENTAL SYSTEM CERTIFIED ISO 14001

AGM Features –

- Specially-engineered safety relief valve system effectively **controls critical internal gas pressure,** preventing capacity loss from excessive gas seepage. This one-way valve also prevents outside air from entering the battery–a common cause of failure in most sealed valve-regulated battery designs.
- Fine microfiber **glass separators are highly porous** to hold electrolyte more efficiently and have extremely low electrical resistance for higher capacity.
- Power path grids are **computer-cast and pasted** to uniform thickness, allowing for the exact degree of compression needed for optimum oxygen flow between the plates and separators. (Plates compressed too tightly will impede oxygen flow, while plates packed too loosely allow valuable oxygen to escape to the top of the battery. Both conditions seriously impair performance and shorten battery life.)
- Exclusive **individual plate formation** provides the highest quality and most consistent performance.†

AGM Benefits –

- **Maintenance-free** construction eliminates the need to add water.
- **Completely sealed** valve-regulated design eliminates acid spills and terminal corrosion.
- **Safer operation** substantially minimizes chance of acid spray, fumes and explosion hazards when charged correctly.
- **Flexible design** can be installed in almost any position. (However, upside-down installation is not recommended.)
- **State-of-charge easily determined** by open circuit voltage.
- **Lower electrical resistance** provides higher discharge rates.
- **High freeze-resistance** offers longer battery life.
- **Resists vibration** damage for longer operating time.
- **Lightweight construction** for easy installation.
- **Requires less charging time** than conventional batteries.

ABSORBED GLASS MAT SERIES

"POWERED FOR PERFORMANCE"®

EAST PENN manufacturing co., inc.

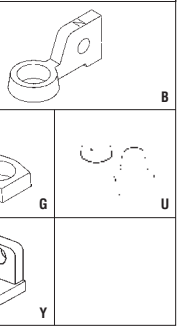
Lyon Station, PA 19536-0147 • Phone: 610-682-6361 • Fax: 610-682-4781
Order Department Hotline: 610-682-4231
www.dekabatteries.com • e-mail: eastpenn@eastpenn-deka.com

DISTRIBUTED BY:

ABSORBED GLASS MAT SERIES

GROUP NO.	PART NO.	FOOTNOTES	MINUTES DISCHARGED AT*						DISCHARGE AMPS PER 12-VOLT BATTERY TO 1.75 VPC @ 80°F (27°C)*						
			75 AMPS	50 AMPS	25 AMPS	15 AMPS	8 AMPS	5 AMPS	5 MINS.	10 MINS.	15 MINS.	20 MINS.	30 MINS.	60 MINS.	90 MINS.
STARTING OR DEEP-CYCLE – EV – TROLLING MOTOR – WHEELCHAIR															
U1	8AU1	2,38,39,Y	10	20	54	98	200	340	110	75	60	50	39	23	16
	8AU1H	2,17,38,39,Y	10	20	54	98	200	340	110	75	60	50	39	23	16
22NF	8A22NF	2,38,39,G	22	40	102	180	365	620	160	120	95	80	62	35.5	28
24	8A24	2,17,38,39,G	35	60	150	280	550	900	220	165	130	110	85	50.5	36
	8A24NH	2,38,39,G	35	60	150	280	550	900	220	165	130	110	85	50.5	36
27	8A27	2,17,38,39,G	43	75	185	330	640	1080	270	200	153	130	98	59	44
31	8A31DT	2,16,17,U	53	87.4	200	348	706	1265	305	226	174	147	114	68.2	49.0
4D	8A4D	2,17	106	180	413	745	1512	2507	508	408	318	266	200	115	85
8D	8A8D	2,17	138	230	517	953	1874	3040	600	475	386	325	256	151	106
GC2	8AGC2	2,G	94	171	409	718	1409	2304	—	—	—	—	—	—	—

GROUP NO.	PART NO.	VOLTS	AMPERE HOUR CAPACITY*					APPROX. WEIGHT LBS. (KGS.)	MAXIMUM OVERALL DIMENSIONS INCHES (MM)						STANDARD/OPTIONAL TERMINALS
			100 HR.	20 HR.	8 HR.	5 HR.	1 HR.		LENGTH		WIDTH		HEIGHT		
STARTING OR DEEP-CYCLE – EV – TROLLING MOTOR – WHEELCHAIR															
U1	8AU1	12	37.0	32.0	29.5	27.5	23.0	24.0 (10.9)	7¾	(197)	5⅛	(130)	7¼	(184)	
	8AU1H	12	37.0	32.0	29.5	27.5	23.0	24.0 (10.9)	8 5/16	(211)	5⅛	(130)	7¼	(184)	
22NF	8A22NF	12	63.0	55.0	50.0	46.5	35.5	38.5 (17.5)	9⅜	(238)	5½	(140)	9¼	(235)	
24	8A24	12	91.0	79.0	72.0	69.2	50.5	53.0 (24.0)	10⅜	(276)	6¾	(171)	9⅞	(251)	
	8A24NH	12	91.0	79.0	72.0	69.2	50.5	53.0 (24.0)	10¼	(260)	6¾	(171)	9⅞	(251)	
27	8A27	12	100.0	92.0	84.0	78.0	59.0	63.0 (28.6)	12¾	(324)	6¾	(171)	9⅞	(251)	
31	8A31DT	12	110.0	105.0	90.0	86.0	68.2	69.0 (31.3)	12 15/16	(329)	6¾	(171)	9⅜	(238)	
4D	8A4D	12	210.0	198.2	176.0	164.0	115.0	129.0 (58.5)	20¾	(527)	8½	(216)	10	(254)	
8D	8A8D	12	250.0	245.0	212.0	197.0	151.1	158.0 (71.7)	20¾	(527)	11	(279)	10	(254)	
GC2	8AGC2	6	220.0	187.0	173.7	163.0	102.6	69.5 (32.0)	10¼	(260)	7⅛	(181)	10⅞	(276)	



FOOTNOTES:

2 - Black cover / Gray case
16 - Dual terminal universal design
17 - Includes handle
38 - "Non-Spillable" defined by DOT (Department of Transportation) definition
39 - "Non-Spillable" defined by ICAO (International Commercial Airline Organization) and IATA (International Airline Transportation Association) definitions
B - Flag terminal w/ 3/8" diameter hole
G - Offset post w/ horizontal hole, stainless steel 5/16" bolt & hex nut
U - Molded-in offset SAE post and vertical 5/16" NEG., 3/8" POS. stainless steel studs & locking hex nuts
Y - Small L terminals with round holes

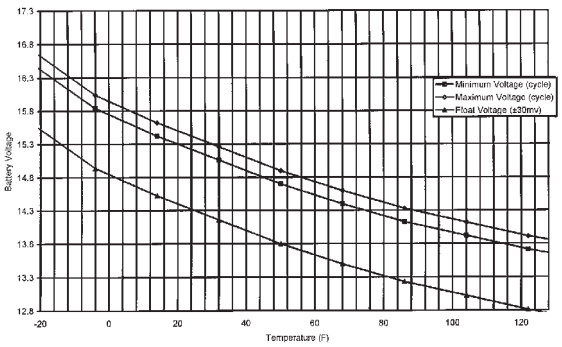
* Nominal

All batteries are manufactured in polypropylene cases.

† Excludes Group U1

Warranty void if opened or improperly charged. Caution: Constant under- or overcharging will damage any battery and shorten its life. Use a good constant potential, voltage-regulated charger. For 12-volt batteries, charge to at least 14.4 volts but no more than 14.6 volts at 68°F (20°C). For 6-volt batteries, charge to at least 7.2 volts but not more than 7.3 volts at 68°F (20°C). Do not charge in a sealed container. The AGM Series has more capacity at high discharge rates than conventional deep cycle batteries.

Constant Voltage vs. Temperature



Shown is the constant charging voltage in relation to the ambient temperature for cyclic and float use.

Potential Applications of AGM

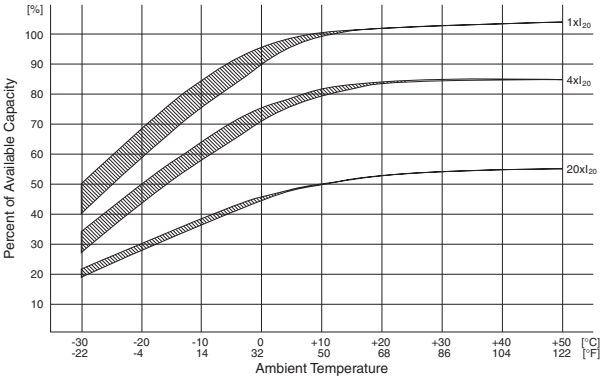
Starting, Lighting and Ignition
Cars • Trucks • Marine • Snowmobiles
Lawn & Garden Tractors

Traction
Wheelchairs • Floor Sweepers • Guided Vehicles
Small Fork Lifts • Trolling Motors

Industrial
Cable TV • Emergency Lighting • Exit Lighting
Alarm and Security Systems • PBX Systems • Utility Control
Switching Equipment • Medical Equipment
Recreational Vehicles • Electronic Cash Registers

Portable Devices
Construction Equipment • Portable Pumps and Generators
Portable Test and Measuring Equipment
Portable Tools • Mobile TV, VCR, VTR

Capacity vs. Operating Temperature



Shown are the changes in capacity for a wider ambient temperature range, giving the available capacity as a percentage of the rated capacity at different ambient temperatures, for three different load examples, with uninterrupted discharge to the appropriate discharge cut-off voltage. The values for the upper edge of the curve were obtained from charging at an ambient temperature of +20°C (68°F) with a voltage limit of 2.3 V/cell. For the lower edge, charging was carried out at the specified ambient temperature. The curves show the behavior of the battery after a number of cycles.

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Valve-Regulated Lead-Acid (VRLA):
Gelled Electrolyte (gel) and Absorbed Glass Mat (AGM) Batteries

EAST PENN Expertise and American Workmanship ***Quality System Certified to ISO 9001***

Introduction

Valve-regulated lead-acid (VRLA) technology encompasses both gelled electrolyte and absorbed glass mat (AGM) batteries. Both types are valve-regulated and have significant advantages over flooded lead-acid products.

More than a decade ago, East Penn began building valve-regulated batteries using tried and true technology backed by more than 50 years experience. East Penn's unique computer-aided manufacturing expertise and vertical integration have created a product that is recognized as the **highest quality, longest lived VRLA battery available from any source.**

East Penn's gel and AGM batteries are manufactured to tough quality standards. East Penn manufactures high power gel and AGM batteries with excellent performance and life.

Applications

VRLA batteries can be substituted in virtually any flooded lead-acid battery application (in conjunction with well-regulated charging), as well as applications where traditional flooded batteries cannot be used. Because of their unique features and benefits, VRLA batteries are particularly well suited for:

Deep Cycle, Deep Discharge Applications

- Marine Trolling
- Electronics
- Sailboats
- Electric Vehicles
- Wheelchairs
- Golf Cars
- Portable Power
- Floor Scrubbers
- Personnel Carriers
- Marine & RV House Power
- Commercial Deep Cycle Applications

Standby and Emergency Backup Applications

- UPS (Uninterrupted Power Systems)
- Cable TV
- Emergency Lighting
- Computer Backup
- Solar Power
- Telephone Switching
- Village Power

Unusual and Demanding Applications

- Race Cars
- Air-transported Equipment
- Off-road Vehicles
- Wet Environments
- Marine & RV Starting
- Diesel & I.C.E. Starting

What is a gel battery?

A gel battery is a lead-acid electric storage battery that:

- is sealed using special pressure valves and should never be opened.
- is completely maintenance-free.*
- uses thixotropic gelled electrolyte.
- uses a recombination reaction to prevent the escape of hydrogen and oxygen gases normally lost in a flooded lead-acid battery (particularly in deep cycle applications).
- is non-spillable, and therefore can be operated in virtually any position. However, upside-down installation is not recommended.

** Connections must be retorqued and the batteries should be cleaned periodically.*

What is an AGM battery?

An AGM battery is a lead-acid electric storage battery that:

- is sealed using special pressure valves and should never be opened.
- is completely maintenance-free.*
- has all of its electrolyte absorbed in separators consisting of a sponge-like mass of matted glass fibers.
- uses a recombination reaction to prevent the escape of hydrogen and oxygen gases normally lost in a flooded lead-acid battery (particularly in deep cycle applications).
- is non-spillable, and therefore can be operated in virtually any position. However, upside-down installation is not recommended.

** Connections must be retorqued and the batteries should be cleaned periodically.*

How does a VRLA battery work?

A VRLA battery is a "recombinant" battery. This means that the oxygen normally produced on the positive plates of all lead-acid batteries is absorbed by the negative plate. This suppresses the production of hydrogen at the negative plate. Water (H_2O) is produced instead, retaining the moisture within the battery. **It never needs watering, and should never be opened** as this would "poison" the battery with additional oxygen from the air. Opening the battery will void the warranty.

What are the differences between gel batteries and absorbed glass mat (AGM) batteries?

Both are recombinant batteries. Both are sealed valve-regulated (SVR) – also called valve-regulated lead-acid (VRLA). AGM batteries and gel batteries are both considered "acid-starved". In a gel battery, the electrolyte does not flow like a normal liquid. The electrolyte has the consistency and appearance of petroleum jelly. Like gelled electrolyte batteries, absorbed electrolyte batteries are also considered non-spillable – all of the liquid electrolyte is trapped in the sponge-like matted glass fiber separator material.

The "acid-starved" condition of gel and AGM batteries protects the plates during heavy deep-discharges. The gel battery is more starved, giving more protection to the plate; therefore, it is better suited for super-deep discharge applications.

Due to the physical properties of the gelled electrolyte, gel battery power declines faster than an AGM battery's as the temperature drops below 32ºF. AGM batteries excel for high current, high power applications and in extremely cold environments.

What is the difference between VRLA batteries and traditional wet batteries?

Wet batteries do not have special pressurized sealing vents, as they do not work on the recombination principle. They contain liquid electrolyte that can spill and cause corrosion if tipped or punctured. Therefore, they are not air transportable without special containers. They cannot be shipped via UPS or Parcel Post or used near sensitive electronic equipment. They can only be installed "upright."

Wet batteries lose capacity and become permanently damaged if:

- left in a discharged condition for any length of time (due to sulfation). This is especially true of antimony and hybrid types.
- continually over-discharged, due to active material shedding. This is especially true of automotive starting types.

Our gel cells have triple the deep cycle life of wet cell antimony alloy deep cycle batteries, due to our unique design. The shelf life of a VRLA battery is seven times higher than the shelf life of a deep cycle antimony battery.

How do VRLA batteries recharge? Are there any special precautions?

While our VRLA batteries accept a charge extremely well due to their low internal resistance, **any** battery will be damaged by continual under- or overcharging. Capacity is reduced and life is shortened.

Overcharging is especially harmful to any VRLA battery because of the sealed design. Overcharging dries out the electrolyte by driving the oxygen and hydrogen out of the battery through the pressure relief valves. Performance and life are reduced.

If a battery is continually undercharged, a power-robbing layer of sulfate will build up on the positive plate, which acts as a barrier to recharging. Premature plate shedding can also occur. Performance is reduced and life is shortened.

Therefore, **it is critical that a charger be used that limits voltage.** The charger must be temperature-compensated to prevent under- or overcharging due to ambient temperature changes. **(See Charging Voltage vs. Ambient Temperature chart on page 11.)**

Important Charging Instructions

The warranty is void if improperly charged. Use a good constant potential, temperature-compensated, voltage-regulated charger. **Constant current chargers should never be used on VRLA batteries.**

Can VRLA batteries be installed in sealed battery boxes?

NO! Never install any type of battery in a completely sealed container. Although most of the normal gasses (oxygen and hydrogen) produced in a VRLA battery will be recombined as described above, and not escape, **oxygen and hydrogen will escape from the battery in an overcharge condition** (as is typical of any type battery).

For safety's sake, these potentially explosive gasses **must** be allowed to vent to the atmosphere and **must never be trapped in a sealed battery box or tightly enclosed space!**

Can our VRLA batteries be used as starting batteries as well?

Our VRLA batteries will work in SLI (Starting, Lighting and Ignition) applications as long as the charging voltage is regulated to the appropriate values from the tables on page 11. Many vehicle regulators are set too high for gel batteries; therefore, the charging system may require adjustment to properly recharge a gel battery for best performance and life.

AGM batteries excel in low temperature, high current applications such as cold weather starting.

What do the ratings and specifications signify for this line?

All ratings are **after 15 cycles** and conform to BCI specifications.

CCA = Cold Cranking Amperes at 0°F (–17.8°C)

Cold cranking amperes equal the number of amperes a new, fully charged battery will deliver at 0°F (–17.8°C) for thirty seconds of discharge and maintain at least 1.2 volts per cell (7.2 volts for a 12-volt battery).

CA = Cranking Amperes at 32°F (0°C)

Same as above, tested at 32°F (0°C).

RC = Reserve Capacity at 80°F (27°C)

The reserve capacity is the time in minutes that a new, fully charged battery can be continuously discharged at 25 amperes and maintain at least 1.75 volts per cell (10.5 volts for a 12-volt battery).

Minutes discharged at 50, 25, 15, 8 and 5 Amperes

Minutes discharged is the time in minutes that a new, fully charged battery will deliver at various currents and maintain at least 1.75 volts per cell. These are nominal or average ratings.

Ampere Hour Capacity at 20, 6, 3 and 1 Hour Rates

Ampere hour capacity is a unit of measure that is calculated by multiplying the current in amperes by the time in hours of discharge to 1.75 volts per cell. These are nominal or average ratings.

EXAMPLE

10 amperes for 20 hours (10 x 20) = 200 Ah @ the 20-hour rate
8 amperes for 3 hours (8 x 3) = 24 Ah @ the 3-hour rate
30 amperes for 1 hour (30 x 1) = 30 Ah @ the 1-hour rate

Therefore, if you have an application that requires a draw of 17 amperes for 3 hours, you would need a 51 Ah battery (@ the 3 hour rate)…(17 x 3 = 51). However, this is 100% of the capacity of this 51 Ah battery.

Most system designs will specify a battery that will deliver a minimum of twice the capacity required. This means the battery will discharge to 50% of its capacity. Using a 50% depth of discharge (versus 80% or 100%) will dramatically extend the life of any battery. Therefore, when helping to specify a battery for a system, choose a battery with at least **twice** the capacity required for best performance. If 50 Ah is required, specify at least a 100 Ah battery.

CHART A

Independent Laboratory Testing BCI 2-Hour Life

Group Size "27" Batteries East Penn Gel and AGM vs. Competitor

This chart compares the cycles run until the battery capacity dropped to 50% of the 15th cycle's capacity (on discharges at the 2-hour rate to a 10.5-volt cutoff).

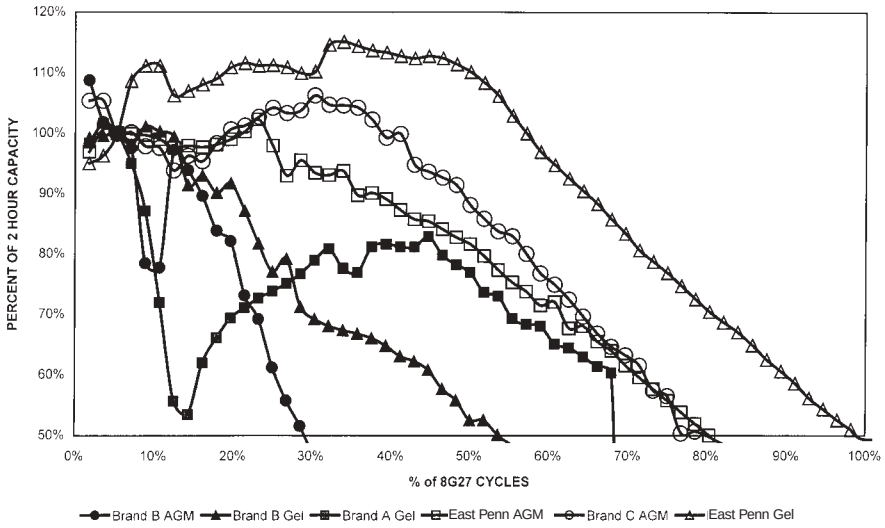


CHART B

Charging Current vs.Charging Time

Shown is the current needed to charge a battery from 0% to 90% state of charge in a given time. Or time required to change a battery from 0% to 90% state of charge at a given current. For example, to charge an 8G8D (curve H) to 90% in 3.5 hours, 100 amperes are required; at 35 amperes, it would take 10 hours

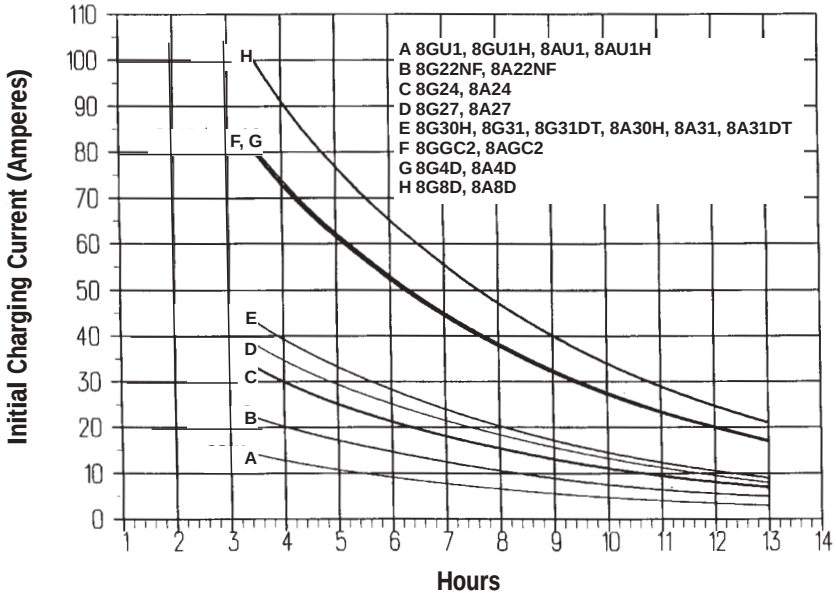


CHART C

VRLA Battery Voltage During Constant Current Discharge

Voltage vs. Percent Discharged

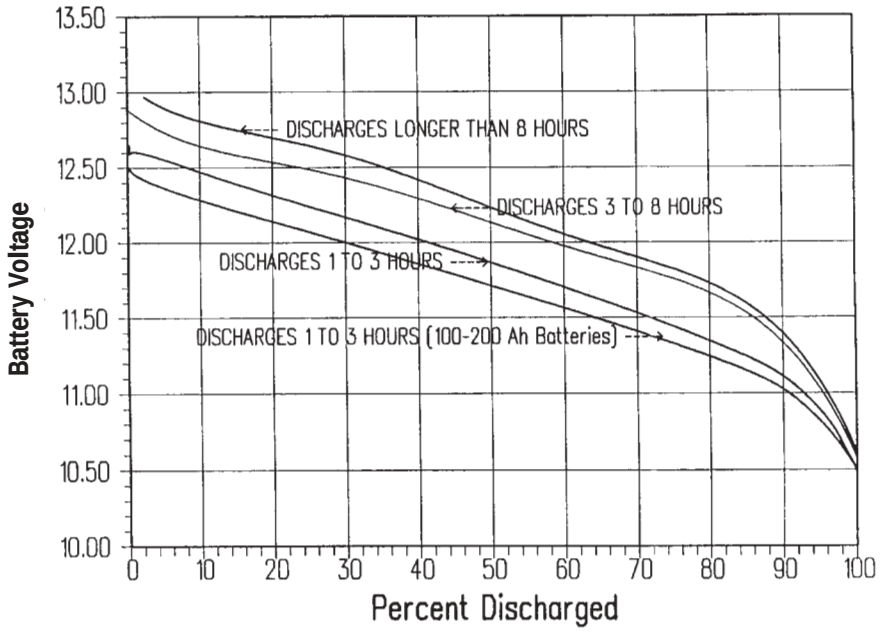
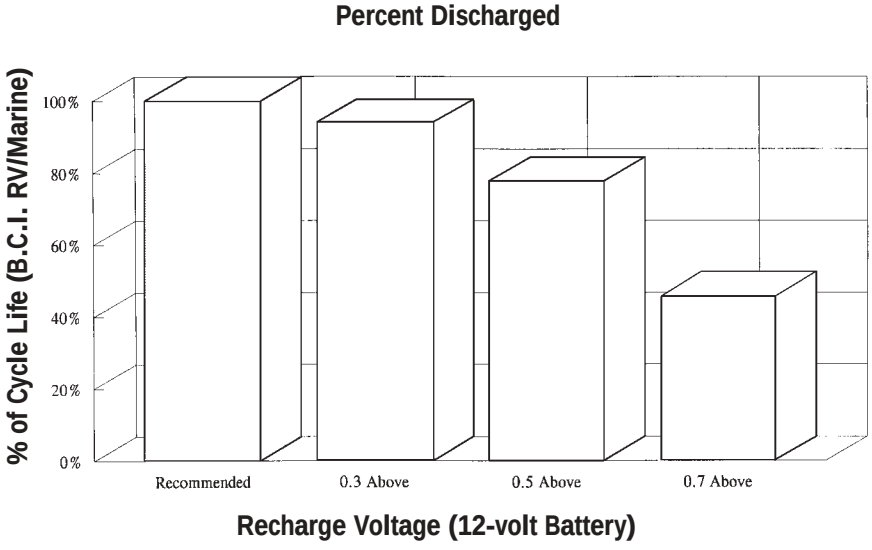


CHART D

Gel Percent Cycle Life vs. Recharge Voltage

This chart shows the effect on life of overcharging a gel battery.
(e.g.: Consistently charging at 0.7 volts above the recommended level reduces life by almost 60%!)



What are the features and benefits that make East Penn's VRLA batteries unique?

East Penn Expertise

East Penn builds VRLA batteries to the highest standards. Our manufacturing process features improved controls using state-of-the art computers and the latest manufacturing technology and equipment. Therefore, the VRLA batteries produced by East Penn consistently meet the highest quality performance and life standards.

Ultrapremium Sealing Valve

A critical feature of any VRLA battery, gelled or absorbed, is the quality of the sealing valve. Not only must the valve keep the cell pressurized and safely release excessive pressure and gas due to overcharging, but it must also keep the cell from being contaminated by the atmosphere. Oxygen contamination will discharge a VRLA battery and eventually ruin the battery.

Our valves are UL recognized and 100% tested after manufacturing. The benefit is **reliable performance and long life.**

Spillproof and Leakproof

A major advantage of VRLA batteries is their spillproof and leakproof feature. However, all VRLA batteries are not created equal in their degree of non-spillability. Some manufacturer's AGM batteries are unevenly filled. Over-saturation of the separators leaves liquid electrolyte that could spill. Under-saturation could lead to premature failure. Some gels do not set properly; they remain liquid and can leak or spill.

Our exclusive gel electrolyte is formulated, mixed and controlled to assure proper "set" in every battery. East Penn's computer-controlled gel mixing and filling equipment ensures homogenization of the mix. This assures a gel battery that will not spill or leak. This feature allows our gel cell to be operated in virtually any position. However, we do not recommend an upside-down orientation.

The AGM filling process assures that each cell is saturated with the maximum amount of electrolyte that can be held by the separators, without leaving excess electrolyte that could spill or leak.

Exclusive Gel Formula

The gelled electrolyte is another critical element in this type of battery. Our gelled electrolyte contains sulfuric acid, fumed silica, pure demineralized, deionized water, and a phosphoric acid additive. The phosphoric acid is a key reason that our batteries deliver **dramatically longer cycle life** than leading gel competitors and 3 times longer cycle life than traditional wet cells.

Exclusive AGM Electrolyte

Our AGM electrolyte contains high purity sulfuric acid and absolutely pure totally demineralized, deionized water to increase battery performance. Since the designs are "acid-starved" to protect the plates from deep discharge, the acid concentration can drop to nearly zero during an extremely deep discharge. Substances that will not dissolve in acid may become soluble when the concentration drops this low. Upon recharge, these dissolved substances crystallize out of the electrolyte, potentially destroying the battery. Our electrolyte prevents these events.

Exclusive Computerized Gel Mixing

Proper gel mixing is critical to life and performance. Consistency in mixing means consistent reliability. We have designed and built the newest, state-of-the-art gel battery manufacturing facility in the world. An example is our proprietary computerized gel mixing operation.

Our exclusive formula is mixed using computer control in every stage of the process. **Computer control delivers superior consistency for gel battery performance that is unequaled.**

Our temperature-controlled process and specially designed equipment assure a homogenous gel. It is important to note that our equipment was designed by our engineers specifically for gel mixing… even down to the contour of the tank bottoms and feed pipe locations. **No other battery manufacturer has comparable equipment.**

Multi-Staged Filling/Vacuuming Operation

Most other manufacturers fill their gel cells in a one step process, vibrating the battery with hopes of releasing most of the air pockets. This system is less than perfect and leaves voids or air pockets at the critical gel-to-plate interface. These voids are non-reactive and reduce overall battery performance.

Our process fills and vacuums each cell several times. This multi-step process assures complete evacuation of air and **complete gel-to-plate interface.** Our computerized process also weighs every battery before and after filling as a check for proper gel levels. The benefit is **more power-per-pound of battery.**

Our AGM topping process assures that the maximum retainable electrolyte quantity is held within the battery separators, without leaving any unabsorbed liquid to spill or leak.

Tank Formed Plates

East Penn is the **only** battery manufacturer that uses tank formation to activate the battery plates. This process **guarantees a fully formed and voltage matched plate.** The extra handling of the plates provides an additional inspection step in the process to verify plate quality.

Ultrapremium, Gel Glass Mat, Double Insulating Separators

Another critical component is the separator, which isolates the positive from the negative plate. The separator must allow maximum charge flow between the plates for maximum performance. Separator failure is a leading cause of warranty claims and customer dissatisfaction.

East Penn uses an **ultrapremium grade separator** in our gel batteries. We believe that this expense (which is 5 to 6 times higher than other types) is worth the benefits of extended life and performance:

- The fiberglass mats embed themselves into the surface of the plates, acting like reinforcing rods in concrete. This extra reinforcement locks the active material onto the plate for longer life and extended performance.
- The ultra-clean separators have no oil contamination or other impurities. Therefore, **resistance is low and battery performance is high.**
- Excellent porosity allows maximum charge flow, which means **more power-per-pound.**
- Superior resistance to oxidation dramatically reduces separator failure, which **extends life.**
- Our separators are **especially suited for gel batteries,** while others use separators designed for flooded automotive batteries.

Ultrapremium AGM glass mat separators

Glass mat separator properties can vary considerably. East Penn uses glass mat engineered to have an ideal balance of properties—i.e. absorbency, compressibility, puncture resistance and electrical resistance. This attention to detail results in high performance and long life.

Exclusive Thru-Partition Weld Seals

One of the causes of self-discharge in batteries is the minute electrical currents that flow between each cell through the partition at the weld area. These currents accelerate the discharge of batteries not in use.

We block these currents by using an **exclusive weld seal** or gasket. This feature **dramatically reduces self-discharge** to less than 3% per month: the lowest self-discharge rate of any battery manufacturer and seven times lower than many conventional batteries!

Exclusive Patented Calcium/Copper Lead Alloy Grids

This exclusive alloy provides **longer shelf life, more power-per-pound and superior corrosion resistance.** By using special grain refiners, we can **dramatically improve performance and life.**

Heavy-Duty Motive Power Style Grid Design

While other manufacturers cut costs by using automotive style grids, we use a high-performance deep cycle grid. This heavy-duty grid design is similar to the grid in a motive power battery.

The hefty "power rods" designed into our grids not only lock the active material onto the grid, but also act as "bus bars" to collect and direct the energy to the terminals. The benefit is **more power-per-pound** of battery for your equipment and **longer battery life.**

Multiple Plate Lug Milling

Shiny, well milled plate lugs are critical to our superior cast-on-strap quality. Each of our plate lugs is automatically milled **to assure the highest quality** strap with no loose or dropped plates. Our lugs are then fluxed and tinned automatically for an **additional assurance of quality.**

Heavier Plate Straps

We use an **exclusive** lead/tin alloy in a unique multi-stage cast-on-strap operation. The result is heavier straps with **outstanding lug-to-strap knit.** This eliminates dropped and loose plates, thereby **improving performance and life.**

Polyester Element Wrap

Another cause of deep-cycle battery failure is "mossing." This phenomenon occurs late in a battery's life, as the positive active material actually grows around the edge of the separator and eventually "shorts" against the negative plate. This ends the battery's service life.

Our AGM separators wrap around the bottom of the plate and are wider than the plates. This makes mossing failures unlikely. To prevent life-shortening mossing in our gel batteries, we use a **special polyester fiber sheet** that is wrapped around the edge of each element, similar to the wrap in an industrial battery. The result is **longer service life.**

Exclusive Forged Posts and Bushings

"Black" posts and oxygen-contaminated batteries are often due to porous lead terminal posts. A battery can lose its critical pressure through tiny pores and fissures in the battery terminals. Pressure loss is harmful to the battery and is evident by black posts, which are caused by sulfuric acid fumes escaping from the battery through and around the lead posts and bushings. These fumes can cause corrosion and can damage sensitive electronic equipment.

These pores and fissures are caused by the industry's method of casting posts and bushings. This method produces tiny air pockets and paths which allow corrosive gas to escape, causing life shortening depressurization, cell dry-out and corrosion damage.

To eliminate this problem, **we use forged terminal posts and bushings,** which are completely solid with absolutely **no porosity.** The benefit is **longer life,** better performance and **no leakage of corrosive gas**…especially important when installed in or near sensitive electronic equipment.

Acid Stratification Prevention

Acid stratification can occur in conventional wet cells. During charge, acid is released at the plate surfaces. During discharge, acid is consumed at the plate surfaces. Since the concentration is not uniform, diffusion (spontaneous mixing by random molecular motions) begins. If this mixing occurred rapidly, stratification would not occur, but it is relatively slow, allowing lighter parts of electrolyte to "float" toward the surface and heavier parts to "sink" toward the bottom.

The top portion of the plates do not perform as well in contact with lower concentration electrolyte. The bottom portion of the plates do not perform as well with the higher concentration, and will corrode prematurely. High voltage "equalization" charging is sometimes used in wet batteries to make gas bubbles that re-mix the electrolyte.

Because the immobilized gel will not "float" or "sink" within itself when a non-uniform concentration exists, it cannot stratify. Therefore, **no high-voltage equalizing charge is necessary.** Simply recharge at the standard 13.8 to 14.1 voltage setting. This means **longer life and consistent performance** in stationary and standby applications.

Electrolyte in an AGM battery is strongly held by the capillary forces between the glass mat fibers, but not completely immobilized. Stratification is possible in extremely tall cells, but cannot occur in batteries of the size covered in this document.

Convenient Carrying Handles

Carrying handles are included on the (gel) 8GU1H, 8G24, 8G27, 8G30H, 8G31DT, 8G31, 8G4D and 8G8D models. Handles are also available on (AGM) 8AU1H, 8A24, 8A27, 8A31DT, 8A4D and 8A8D. **This feature makes carrying, installation and removal easier, more convenient and less time consuming.**

Dozens of Terminal Options Available

Our batteries are delivered with the most popular type of terminal; however, on a special order basis **many terminal options are available.** This gives you total flexibility to specify the **proper terminal for your application**… without making compromises.

Proprietary Case, Cover, and Pressure Vent

We design and mold our own rugged polypropylene cases, vents and covers in our on-site, state-of the-art plastics molding facility. This provides **ultimate control** of our high performance designs, quality and delivery to our manufacturing plant, **assuring you the highest quality** battery and most reliable service.

Environment and Worker Protection

It's nice to know that every possible safeguard was designed into our process to **protect our co-workers and the environment**… special safeguards that are exclusive to East Penn. One benefit is assurance of a consistent source for batteries without fear of governmental interference or delays.

Over 250 Quality Assurance Checks

Hundreds of quality checks are performed to assure total confidence in the performance and life of our batteries.

For example:

- **100% Cycling.** After initial charging, **every battery is discharged and then recharged** at the factory. This allows us to check the performance of the battery and give it a second charge that **equalizes the cells for improved performance and longer life**.

  It's interesting to note that, as a cost-saving measure, we use the current generated during the initial discharge to recharge other batteries in this computer-controlled process.

- **Extended Shelf Stand Test.** Before shipment, every battery is required to stand for a designated period of time. Beginning and ending voltages are compared. This **extra quality assurance step** verifies that the critical pressure control valves are functioning properly.

- **Filling Weight Control.** During this computerized process, batteries are weighed before and after filling. This **assures that the exact amount of electrolyte** is in each battery.

- **Multi-Staged Filling and Vacuuming Process.** Every battery is filled and vacuumed several times during this computerized process. Multi-staged vacuuming **assures complete electrolyte-to-plate interface,** with no power-robbing air pockets.

- **Computerized Polarity Check.** Every battery is checked by computer for proper polarity.

- **High Rate Discharge Test.** Every battery is discharged at approximately twice the rated capacity. A sensitive computer monitors the voltage drop during this discharge to assure that every battery performs as designed.

- **Formed Element Inspection.** Elements are assembled and **charged outside the battery container** in a computerized forming and drying process. This allows visual inspection of every grid, plate, separator, and formed element before being sealed inside the battery, assuring perfect cell elements with longest life and highest performance.

- **Tank Formed Plates.** Voltage matched plates are critical in standby applications. Forming each plate outside the battery assures the **highest quality,** best matched plates in the industry, and also allows a visual check before and during assembly.

State-of-the-Art Technology

Within our newly constructed multi-million dollar VRLA production facility, we have incorporated **state-of-the-art manufacturing processes** that are unmatched by any other battery manufacturer. This major addition allows us to build the **most modern and reliable VRLA batteries in the industry.**

The designs of East Penn's VRLA batteries are always improving. The preceding sections accurately describe East Penn's VRLA products as of the date of publication. East Penn reserves the right to change their processes to improve quality, value or utilize advances in manufacturing technology. Ratings and capacities may change without notice.

How do East Penn's VRLA battery features compare with other types of batteries?

	FEATURE	EPM GEL	OTHER GEL	EPM AGM	0THER AGM	ALL WET CELLS
1.	EPM Expertise	YES	NO	YES	NO	EPM ONLY
2.	Spillproof and Leakproof	YES	YES	YES	YES	NO
3.	Sealed Valve-Regulated	YES	YES	YES	YES	NO
4.	Ultra-Premium Sealing Valve	YES	NO	YES	NO	NO
5.	Exclusive Gel Formula	YES	NO	NO	NO	NO
6.	Deep Discharge Protection	YES	YES	YES	YES	NO
7.	Exclusive Computerized Gel Mixing	YES	NO	NO	NO	NO
8.	Tank Formed Plates	YES	NO	YES	NO	NO
9.	Multi-Staged Gel Filling/Vacuuming	YES	NO	NO	NO	NO
10.	Ultra-Premium Glass-Mat Dual Insulating Separators	YES	NO	NO	NO	NO
11.	Exclusive Thru-Partition Weld Seals	YES	NO	YES	NO	NO
12.	Exclusive Patented Calcium/Copper Lead Alloy Grids	YES	NO	YES	NO	NO
13.	Heavy-Duty Motive Power Style Grids	YES	NO	YES	NO	NO
14.	Grid Lug Milling, Brushing and Fluxing	YES	?	YES	NO	EPM ONLY
15.	Heavy-Duty Special Alloy Plate Straps	YES	NO	YES	NO	NO
16.	Special Polyester "Moss Guard" Element Wrap	YES	NO	NO	NO	NO
17.	Forged Posts and Bushings	YES	NO	YES	NO	EPM ONLY
18.	Acid Stratification Prevention	YES	YES	YES	YES	NO
19.	Carrying Handles	YES	?	YES	LIMITED	LIMITED
20.	Dozens of Terminal Options	YES	?	YES	?	EPM ONLY
21.	Highest Cycle Life	YES	NO	YES	NO	NO
22.	Highest Performance	YES	NO	YES	NO	N.A.
23.	Shelf Stand Test	YES	?	YES	NO	NO
24.	250+ Quality Assurance Checks w/ ISO 9001 Certification	YES	?	YES	NO	EPM ONLY
25.	State-of-the-Art Technology & Facility	YES	NO	YES	NO	EPM ONLY

Answers to the Most Frequently Asked Questions

NOTE: Before reviewing this section, be sure you understand the difference between gel, AGM, and flooded batteries.

How do we justify the premium price of VRLA batteries to those unfamiliar with this type of battery?

Simply review the advantages, features and benefits, performance, and **impressive life cycle results.** Based upon this and the **lowest cost-per-month or duty cycle** you and/or your customer should have no trouble choosing VRLA batteries.

However, please remember that these batteries are not for everyone or every application. Always be aware of the charging considerations. (See pages 11 & 12.)

What are the advantages and disadvantages of the different types of battery designs?

Gelled Electrolyte Advantages:

- Totally maintenance-free
- Air transportable
- Spillproof/leakproof
- No corrosion
- Superior deep cycle life
- Installs upright or on side (side installation may lose about 10% capacity)
- Very low to no gassing (unless overcharged)
- Compatible with sensitive electronic equipment
- Superior shelf life
- Superior rechargeability (from 0% to 90% in 3½ hours)
- No recharge current limitation @ 13.8 volts
- Rugged and vibration-resistant
- Very safe at sea with no chlorine gas in bilge (due to sulfuric acid and salt water mixing)
- Versatile: Starting, Deep Cycle, Stationary
- Operates in wet environments…even under 30 feet of water
- Will not freeze to –20°F/–30°C (if fully charged)
- Lowest cost-per-month (cost ÷ months of life)
- Lowest cost-per-cycle (cost ÷ life cycles)

Gelled Electrolyte Disadvantages:

- Higher initial cost
- Heavier weight
- Water cannot be replaced if continually overcharged
- Automatic temperature-sensing, voltage-regulated chargers **must** be used
- Charge voltage **must** be limited to extend life (13.8 to 14.1 volts maximum at 68°F)

Absorbed Electrolyte Advantages:

- Totally maintenance-free
- Air transportable
- Spillproof/leakproof
- No corrosion
- Installs upright or on side
- Lower cost than gel cell batteries
- Compatible with sensitive electronic equipment
- Very low to no gassing (unless overcharged)
- Excellent for starting and stationary applications
- Superior for shorter duration/higher rate discharges
- Superior under extreme cold conditions when fully charged
- Superior shelf life
- Superior rechargeability (from 0% to 90% in 3½ hours)
- Rugged and vibration-resistant
- Very safe at sea with no chlorine gas in bilge (due to sulfuric acid and salt water mixing)
- Operates in wet environments…even under 30 feet of water

Absorbed Electrolyte Disadvantages:

- Shorter cycle life than gel in very deep cycle applications
- Automatic temperature-sensing, voltage-regulated chargers **must** be used
- Water cannot be replaced if continually overcharged
- Charge voltage **must** be limited (14.4 to 14.6 volts maximum at 68°F)

Flooded Electrolyte Advantages:

- Lowest initial cost
- Higher cranking amps
- Water can be added (if accessible)
- Excellent for starting applications
- Tolerant of improper recharge voltage
- Certain designs are good for deep cycle applications
- Replacements readily available
- Good under extreme cold conditions when fully charged

Flooded Electrolyte Disadvantages:

- Spillable
- Operates upright only
- Shorter shelf life
- Fewer shipping options
- Cannot be installed near sensitive electronic equipment
- Watering may be required (if accessible)

Why can't VRLA batteries be opened?

VRLA (Valve-Regulated Lead-Acid) batteries, sometimes called SLA (Sealed Lead-Acid) batteries or SVR (Sealed Valve-Regulated) batteries work on a recombination principle. Oxygen gas is produced at the positive plates during charge. The charged negative plates react first with this oxygen and subsequently with the electrolyte. Water is produced and the negative plates are very slightly discharged. Additional charging recharges the negative plates instead of producing hydrogen gas. Since very little hydrogen and oxygen is lost and the water (H_2O) is retained, we say that the gasses have recombined. To work properly, the oxygen produced must be retained in the battery until the reaction is completed. Positive pressure allows the gas to be retained.

If any VRLA (gelled or absorbed electrolyte) battery is overcharged, gas will be vented from the valves. Hydrogen as well as oxygen will be released. If continued, the electrolyte will eventually dry out and the battery will fail prematurely. This is why charging limits are so critical.

In a sealed battery a balance is maintained between the hydrogen, oxygen and charge. If a VRLA battery is opened, or leaks, the negative plates are exposed to extra oxygen from the atmosphere. This excess oxygen upsets the balance. The negative plates become discharged. The positive plates may be subsequently severely overcharged. The battery ***will*** fail prematurely, and the **warranty will be voided.**

Some say calcium grids don't do well in flooded deep cycle applications. Why does East Penn use calcium grids in VRLA batteries for deep cycle applications?

Flooded calcium alloy makes a very efficient, low resistance battery. Therefore, when deeply discharged, the plates release all their available power, eventually causing plate shedding and active material fall-out. In contrast, with flooded antimony batteries, the antimony helps lock the active material onto the grid. Therefore, the plate does not shed as easily, which extends the deep cycle life of the battery when compared to flooded calcium.

Our VRLA calcium alloy battery **(East Penn's exclusive patented alloy)** is also very efficient with low resistance. However, when deeply discharged, the electrolyte is used up before the plates are totally discharged because the battery is "acid-starved." This feature:

- limits the discharge the plates can deliver.
- protects the plates from shedding due to deep discharge.
- extends the life of the battery.

Why do EPM VRLA batteries have longer cycle life than others?

Some of the major features that contribute to our long cycle life are:

- Our patented calcium/copper grid alloy **delivers superior performance** due to the purity of the lead. Copper is added as a "grain refiner." This means that the microscopic grains in our lead grids are odd-shaped, so they retard corrosion and **extend the life** of our grid.
- Our **thicker grids** have more corrosion resistance than thinner grids.
- Our VRLA batteries are protected against deep discharge because they are **"acid-starved."** This means that the battery uses the power in the acid before it uses the power in the plates. Therefore, the **plates are never subjected to destructive ultra-deep discharges.**
- With proper temperature-sensing, voltage-regulated charging (refer to table on page 11) the VRLA battery **never runs out of water.**
- Our gel batteries contain ultra-premium, **glass-mat,** dual-insulating separators which will not break down in service. The glass mat embeds itself into the plate, which **retards life-shortening shedding.**
- Our gel batteries contain polyester element wrap which **retards "mossing"** or active material growth that causes short circuits.
- Our AGM batteries contain separators at the ideal compression and ideal saturation to achieve the best balance between capacity utilization and recombination efficiency.
- Over **250 quality control checks** assure superior performance and long battery life.

Why do EPM VRLA batteries have longer shelf life?

Our calcium/copper lead alloy premium separators and demineralized electrolyte are **ultra-pure.** Impurities in the lead alloy, separators and electrolyte cause tiny currents inside a cell which eventually discharge the battery and shorten its shelf life. **The purer the components, the longer the shelf life.** No one can match East Penn's purity!

Our exclusive **"weld seal gasket"** blocks the minute cell-to-cell currents that cause self-discharge. The better the weld seal, the longer the shelf life. Weld seals are **exclusive** to East Penn VRLA batteries.

Does depth of discharge affect cycle life?

Yes! The harder any battery has to work, the sooner it will fail.

Typical* VRLA Battery Cycling Ability vs. Depth of Discharge

	Typical Life Cycles	
Capacity Withdrawn	**Gel**	**AGM**
100%	450	150
80%	600	200
50%	1000	370
25%	2100	925
10%	5700	3100

** You may experience longer or shorter life based upon application, charging regimen, temperature, rest periods, type of equipment, age of battery, etc.*

As you can see, **the shallower the average discharge, the longer the life.** This is why it's important to size a battery system to deliver at least twice the average power required, to assure shallow discharges.

Follow these tips for the longest life:

- Avoid ultra-deep discharges.
- Don't leave a battery at a low stage of charge for an extended length of time. Charge a discharged battery as soon as possible.
- Don't cycle a battery at a low state of charge without regularly recharging fully.
- Use the highest initial charging current available (up to 30% of the 20-hour capacity per hour) while staying within the proper temperature-compensated voltage range.

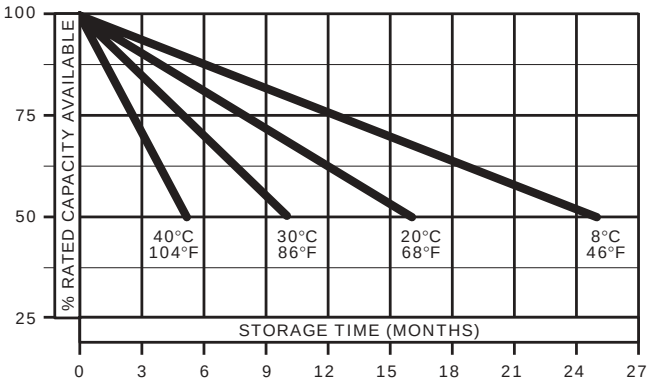
Why can't EPM VRLA batteries be discharged too low?

Our VRLA batteries are designed to be **"acid-starved."** This means that the power (sulfate) in the acid is used before the power in the plates. This design protects the plates from ultra-deep discharges. Ultra-deep discharging is what causes life-shortening plate shedding and accelerated positive grid corrosion which can destroy a battery.

Why does temperature have such a dramatic effect on batteries?

Temperature is a major factor in battery performance, shelf life, charging and voltage control. At higher temperatures there is dramatically more chemical activity inside a battery than at lower temperatures. The following charts graphically illustrate this fact.

Typical Self-Discharge of VRLA Batteries at Different Temperatures



AGM Charge and Float Voltages at Various Temperature Ranges

Temp. °F	Charge		Float		Temp. °C
	Optimum	Maximum	Optimum	Maximum	
≥ 120	13.60	13.90	12.80	13.00	≥ 49
110 – 120	13.80	14.10	12.90	13.20	43 – 49
100 – 110	13.90	14.20	13.00	13.30	38 – 43
90 – 100	14.00	14.30	13.10	13.40	32 – 38
80 – 90	14.10	14.40	13.20	13.50	27 – 32
70 – 80	14.30	14.60	13.40	13.70	21 – 27
60 – 70	14.45	14.75	13.55	13.85	16 – 21
50 – 60	14.60	14.90	13.70	14.00	10 – 16
40 – 50	14.80	15.10	13.90	14.20	4 – 10
≤ 40	15.10	15.40	14.20	14.50	≤ 4

Gel Charge and Float Voltages at Various Temperature Ranges

Temp. °F	Charge		Float		Temp. °C
	Optimum	Maximum	Optimum	Maximum	
≥ 120	13.00	13.30	12.80	13.00	≥ 49
110 – 120	13.20	13.50	12.90	13.20	44 – 48
100 – 109	13.30	13.60	13.00	13.30	38 – 43
90 – 99	13.40	13.70	13.10	13.40	32 – 37
80 – 89	13.50	13.80	13.20	13.50	27 – 31
70 – 79	13.70	14.00	13.40	13.70	21 – 26
60 – 69	13.85	14.15	13.55	13.85	16 – 20
50 – 59	14.00	14.30	13.70	14.00	10 – 15
40 – 49	14.20	14.50	13.90	14.20	5 – 9
≤ 39	14.50	14.80	14.20	14.50	≤ 4

What is acid stratification? How do VRLA batteries prevent it?

See page 6 for a detailed explanation of this phenomenon.

How does a battery recharge?

The process is the same for all types of lead-acid batteries: flooded, gel and AGM. The actions that take place during discharge are the reverse of those that occur during charge.

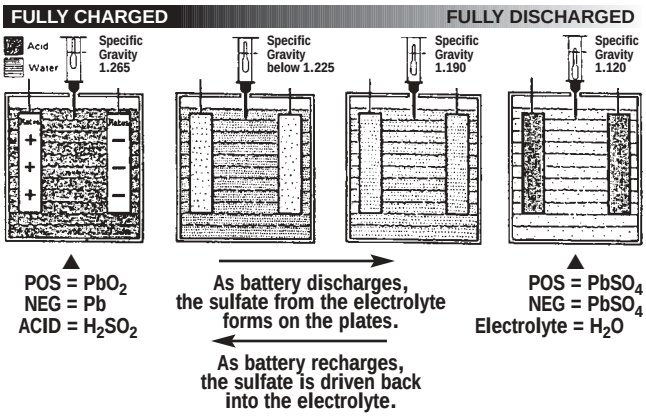
The discharged material on both plates is lead sulfate ($PbSO_4$). When a charging voltage is applied, charge flow occurs. Electrons move in the metal parts; ions and water molecules move in the electrolyte. Chemical reactions occur at both the positive and negative plates converting the discharged material into charged material. The material on the positive plates is converted to lead dioxide (PbO_2); the material on the negative plates is converted to lead (Pb). Sulfuric acid is produced at both plates and water is consumed at the positive plate.

If the voltage is too high, other reactions will also occur. Oxygen is ripped from water molecules at the positive plates and released as a gas. Hydrogen gas is released at the negative plates—unless, oxygen gas can reach the negative plates first and "recombine" into H_2O.

A battery will "gas" near the end of charge because the charge rate is too high for the battery to accept. A temperature-compensating, voltage-regulating charger, which automatically reduces the charge rate as the battery approaches the fully charged state, eliminates most of this gassing. **It is extremely important not to charge batteries for long periods of time at rates which cause them to gas** because they use water, which in sealed valve-regulated batteries cannot be replaced. Of course, no battery should be overcharged for a long period of time…even at low rates using so-called "trickle charges."

In a fully charged battery, most of the sulfate is in the sulfuric acid. As the battery discharges, some of the sulfate begins to form on the plates as lead sulfate ($PbSO_4$). As this happens, the acid becomes more dilute, and its specific gravity drops as water replaces more of the sulfuric acid. A fully discharged battery has more sulfate in the plates than in the electrolyte.

The following illustration shows the relationship between specific gravity readings and the combination of the sulfate from the acid with the positive and negative plates at various states of charge.



How critical is recharge voltage? Why are all VRLA batteries so charge sensitive?

All lead-acid batteries give off hydrogen from the negative plate and oxygen from the positive plate during charging.

VRLA batteries have pressure-sensitive valves. Without the ability to retain pressure within the cells, hydrogen and oxygen would be lost to the atmosphere, eventually drying out the electrolyte and separators.

Voltage is electrical pressure. Charge (ampere-hours) is a quantity of electricity. Current (amperes) is electrical flow (charging speed). A battery can only store a certain quantity of electricity. The closer it gets to being fully charged, the slower it must be charged. Temperature also affects charging.

If the right pressure (voltage) is used for the temperature, a battery will accept charge at its ideal rate. If too much pressure is used, charge will be forced through the battery faster than it can be stored. Reactions other than the charging reaction occur to transport this current through the battery—mainly gassing. Hydrogen and oxygen are given off faster than the recombination reaction. This raises the pressure until the pressure relief valve opens. The gas lost cannot be replaced. Any VRLA battery will dry out and fail prematurely if it experiences excessive overcharge. **Note:** It is the pressure (voltage) that initiates this problem—a battery can be "over-charged" (damaged by too much voltage) even though it is not fully "charged."

This is why charging voltage must be carefully regulated and temperature compensated to the values on page 11.

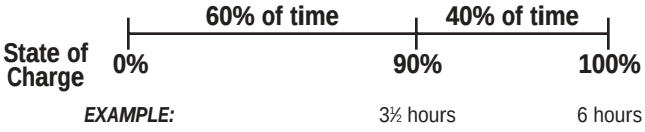
How long does it take to recharge a fully discharged VRLA battery?

A **specific time is difficult to determine** because recharging depends on so many variables:

- Depth of discharge
- Temperature
- Size and efficiency of the charger
- Age and condition of the battery

See the following Charging Guides for an estimated time based upon the initial charge current the battery accepts.

Typical Charging Time vs. 90% and 100% State of Charge



It will take about 60% of the charge time to bring a VRLA battery from 0% charged to 90% charged. It will take the remaining 40% of the total charging time to put the last 10% of the charge back into the battery.

Charge is a quantity of electricity equal to rate of flow (Amperes) times time (hours), and usually expressed in Ampere-hours (Ah).

0% state of charge is defined as the depth of discharge giving a terminal voltage of 10.50 Volts – measured under a steady load at the 20-hour rate at 80ºF. (The 20-hour rate is the 20-hour capacity divided by 20 hours.)

Typically, the charge that must be returned to a VRLA battery to achieve a 100% state of charge is from 105% to 115% of the charge removed.

Charging Guides

Typical Charge Time vs. Initial Charge Current to 90% Full Charge

(Using an automatic temperature-sensing, voltage-regulating charger set at 13.8V. Totally discharged battery at 11.80–12.0 volts.)

	Initial Amperes		
Part No.	**13 hrs***	**6 hrs***	**3½ hrs***
8GU1, 8GU1H, 8AU1, 8AU1H	3	8	15
8G22NF, 8A22NF	5	12	23
8G24, 8A24	7	17	33
8G27, 8A27	8	21	41
8G30H, 8G31, 8G31DT, 8A30H, 8A31, 8A31DT	9	24	45
8G4D, 8GGC2, 8A4D, 8AGC2	17	42	83
8G8D, 8A8D	20	50	100

**approximate*

HOW TO USE THIS CHART: When charger is first turned on, read amps after about one minute. Initial ampere reading will indicate approximate charging time.

EXAMPLE
If an 8G24 reads about 17 ampere charge current when first turned on, the battery will be at 90% in about 6 hours.

IMPORTANT: Always use an automatic temperature-sensing, voltage-regulated charger! Set charger at 13.8 to 14.1 volts at 68°F for gel, or 14.4 to 14.6 volts at 68°F for AGM. Do not exceed 14.1 volts for gel or 14.6 volts for AGM.

How can continual undercharging harm a battery?

In many respects, **undercharging is as harmful as overcharging.** Keeping a battery in an undercharged condition allows the positive grids to corrode and the plates to shed, dramatically shortening life. Also, an undercharged battery must work harder than a fully charged battery, which contributes to short life as well.

An undercharged battery has a greatly reduced capacity. It may easily be inadvertently over-discharged and eventually damaged.

How can you tell if an VRLA battery is fully charged?

By using a voltmeter.

Open Circuit Voltage vs. State of Charge Comparison*

% Charge	Open Circuit Voltage		
	Flooded	Gel	AGM
100	12.60 or higher	12.85 or higher	12.80 or higher
75	12.40	12.65	12.60
50	12.20	12.35	12.30
25	12.00	12.00	12.00
0	11.80	11.80	11.80

NOTE: Divide values in half for 6-volt batteries.

** The "true" O.C.V. of a battery can only be determined after the battery has been removed from the load (charge or discharge) for 24 hours.*

How can you tell if a VRLA battery has been damaged by under- or overcharging?

The only way is **with a load test.** Use the same procedure you would use with a wet cell battery:

a. Recharge if the open circuit voltage is below 75%.

b. If adjustable, set the load at ½ the CCA rating or three times the 20 hour rate.

c. Apply the load for 15 seconds. The voltage should stabilize above 9.6 volts while on load.

d. If below 9.6 volts, recharge and repeat test.

e. If below 9.6 volts a second time, replace the battery.

What is a float charger? What float voltage is recommended?

This type of charger continually delivers a pre-set voltage to the battery, regardless of charge conditions.

These chargers are used in stationary, emergency back-up power, emergency lighting, and other applications.

The frequency of discharge and temperature will dictate a more exact setting. For example, the more frequent the discharge, the higher the suggested recharge voltage, to **a maximum of 2.35 volts per cell (at 20°C/68°F).**

Our recommended float voltage is 2.25 to 2.3 volts per cell for gel and absorbed models.

What is a thermal runaway?

The appropriate charge voltage depends on the battery temperature (see page 11). A warmer battery requires a reduced voltage. If the voltage is not reduced, current accepted by the battery increases. When the current increases, the heating increases. This can continue in a loop feeding on itself with the battery temperature and charging current rising to destructive levels.

Gel batteries are much less susceptible to thermal runaway than AGM batteries. Batteries may become more susceptible with increasing age. Without a recombination reaction, flooded batteries convert most excess charging energy to gas, not heat. This makes them almost immune from the thermal runaway.

Thermal runaway can be prevented with:

- Temperature compensation monitoring at the battery—not at the charger.
- Limiting charging currents to appropriate levels (see page 11).
- Allowing for adequate air circulation around the batteries.
- Using timers, or Ampere-hour counters.
- Using smart chargers that recognize the signature of a thermal runaway event which will shut the charger down.

How do I know if a charger is "gel friendly" or "AGM friendly"?

Unfortunately, many chargers on the market claim to be gel "friendly" or "OK for sealed batteries", but are not. Some overcharge the batteries, while others may not fully charge the batteries. Some chargers claim to be "smart". Some "smart" chargers do a good job, others do not. The best choice of charger often depends on the application.

Use only "voltage-regulated" or "voltage-limited" chargers. **Standard constant current or taper current chargers must not be used. The voltage must fall in the range of the chart on page 11.** Almost all applications require temperature sensing and voltage compensation. Beware, many chargers measure the ambient temperature which could be significantly different from the battery's internal temperature.

Low frequency current ripple (to about 333 Hz) can be detrimental to sealed batteries depending on the application. On applications where the charger is connected continuously to a float voltage, especially where simultaneous charge and discharge may occur, the level of current ripple must be a consideration.

If you are not sure if a charger is performing properly, follow this procedure:

a. Using a fully discharged VRLA battery (OCV about 11.8V) and a digital voltmeter, record the initial open circuit voltage at the battery terminals.

b. Using an automatic charger as described above, set voltage if adjustable (14.1V for gel, 14.4V for AGM models).

c. Connect and start charging. Record initial on-charge voltage and current .

d. Each hour or so, check and record the on-charge voltage across the battery terminals. Except for occasional, brief "blips" or pulses, the voltage should not exceed the voltage limits noted in "b" above.

e. At the end of charge (when the current is very low or goes to zero) check and record the voltage. Note that the charger may have turned off by then.

f. The disconnected battery should be at 100% or above after a 24 hour rest.

During the charging time, the charger should not have exceeded the limit (except for occasional, brief pulses). This indicates that the charger is working properly.

Keep in mind that the voltage limit is at 68°F/20°C. Charging at higher or lower temperatures will change this limit.
A temperature-sensing charger should always be used, as manual adjustments are never accurate and will damage any VRLA battery.

Do VRLA batteries have a "memory" like ni-cad batteries?

One of the major disadvantages of nickel-cadmium (ni-cad) batteries is that after shallow discharge cycles, the unused portions of the electrodes "remember" the previous cycles and are unable to sustain the required discharge voltage beyond the depth of the previous cycles. The capacity is lost and can only be restored by slowly discharging completely (generally outside the application), and properly recharging. **VRLA batteries do not exhibit this "use it" or "lose it" capacity robbing effect known as memory.**

What is a safe charge rate or voltage setting for outdoor applications with wide temperature fluctuations if a temperature-sensing charger is not available?

NONE! As the chart on page 11 (Effect of Temperature on Recharge Voltage) shows, charging voltage varies widely with temperature. **There is no fixed voltage setting or current that will work.** A temperature-sensing, voltage-regulated charger must be used. Anything else will damage any battery and **cause premature failure!**

Can a VRLA battery be load tested?

Yes. See page 13 (How can you tell if a VRLA battery has been damaged by under- or overcharging?).

Why do some VRLA batteries bulge? Why do some VRLA batteries appear "sucked in"? Are there visual signs of a faulty or plugged pressure relief valve?

To prevent the permanent loss of gases so that recombination has time to take place, each cell can hold up to about 1.5 psi without venting.

Batteries with very large cells, such as the 8G4D, 8G8D, 8A4D, 8A8D and 8GGC2, will bulge somewhat as this normal pressure builds. This is especially true in higher temperatures, because the polypropylene case is pliable. Therefore, **a certain amount of bulge is normal.**

The valves only let gas out, never in. A partial vacuum can form within a sealed battery under various circumstances. Battery temperature and ambient pressure play a role, but predominantly the recombination and discharge reactions are responsible. After charging ends, the recombination reaction continues until most of the oxygen in the battery headspace is consumed. The total volume of the battery components decreases slightly during a discharge. Deeply discharged batteries often have a "sucked-in" appearance. Batteries with large cells may display this appearance even when fully charged.

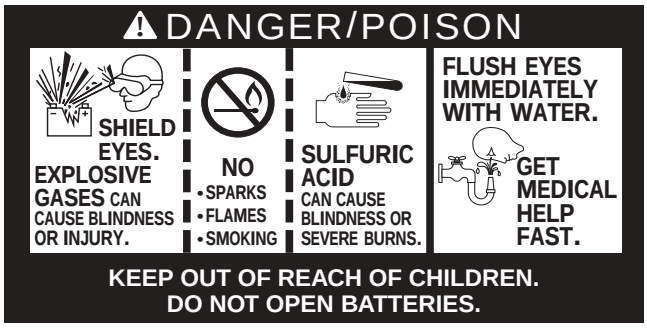
If a battery bulges severely on charge, this is not normal. It is an indication of a blocked valve or an overcharge situation. Such a battery should be removed from service.

A sucked-in appearance can also be normal. A sucked-in battery should be charged, but if it remains sucked-in after charging, the appearance can safely be ignored; however, if only a single cell displays or lacks this appearance a load test would be prudent.

How safe are VRLA batteries? Can they explode?

VRLA batteries are very safe, unless abused. However, as with any type battery, certain safety precautions must be taken.

**ALWAYS WEAR SAFETY GLASSES
WHEN WORKING AROUND BATTERIES!**



CALIFORNIA PROPOSITION 65 WARNING: Batteries, battery posts, terminals and related accessories contain lead and lead compounds and other chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **Wash hands after handling.**

Because VRLA batteries normally emit very little to no hydrogen gas, they are safe near sensitive electronic equipment. They do not cause corrosion of surrounding metals. No hydrogen gas means no dangerous explosions… UNLESS SEVERELY OVERCHARGED!

Do not install any lead-acid battery in a sealed container or enclosure. Hydrogen gas from overcharging must be allowed to escape.

DO NOT CHARGE IN EXCESS OF 14.1V @ 68°F - Gel Cells
14.6V @ 68°F - Absorbed

Always use a reliable, temperature-sensing, voltage-regulated, automatic charger.

Because SVR batteries have immobilized electrolyte, they cannot spill or leak, even if punctured. That is why they are approved for air transport by the International Commercial Airline Organization (ICAO), International Airline Transport Association (IATA), and Department of Transportation (DOT) as noted on the label if properly insulated from short circuits.

Also, when protected against short circuits and securely braced/blocked, our VRLA batteries "are not subject to any other requirements of 49 CFR Parts 171-180…" for shipping.

Which way does current flow? On which side should a circuit breaker be installed?

During discharge, electrons progress through the external circuit from the negative post toward the positive post. Inside the battery, positive ions move toward the positive plate by diffusion where they react, leaving neutral molecules in solution. The resulting neutral molecules move back toward the negative plate by diffusion. There are also negative ions in the electrolyte offsetting the positive ion charges. Some travel by diffusion toward both the negative and the positive plates, where they are consumed. During charge, all of the directions reverse.

Although not physically accurate, when designing circuits or making calculations, it is just as valid to consider positive charges moving through the whole circuit. Indeed, this is the convention used to define the direction of current in electronics (known as conventional current).

Proper location of disconnects depends on the application. Vehicles can vary, but in most cases, the negative terminal is treated as ground. The entire chassis is connected to the negative terminal of the battery. The positive side of the circuit is considered "hot." **Switches/circuit breakers should usually be installed on the hot side of a device.** When disconnecting the entire battery from the system with a fusible link or circuit breaker, breaking the connection from the negative terminal to the chassis often works best.

In multiple battery installation, there could be other considerations such as total voltage, multiple voltages, and the effects on other devices.

What do I need to know about installation, especially in salt water marine applications?

Wiring and Waterproofing

ALWAYS WEAR SAFETY GLASSES
WHEN WORKING AROUND BATTERIES!

a. Cabling of the approved gauge should be tinned copper. If using untinned copper, allow plenty of spray silicone to "wick" along the strands.

b. Install heat-shrink tubing with a silicone interior; the silicone forms an excellent moisture barrier. Cut the tubing long enough to cover the terminal lug and plenty of the insulated portion of the cable. Slip tubing onto the cable.

c. Crimp on the appropriate terminal.

d. Position the heat-shrink tubing. Heat and inspect.

e. Clean battery terminals and connect. Be sure perfect metal-to-metal contact is made, with no dirt, corrosion, grease or foreign material to interfere with current flow.

f. Always attach the cable connected to the solenoid or starter first. Attach the ground cable last! Tighten snugly, BUT DO NOT OVERTIGHTEN, which will damage the terminals or crack the battery cover. This will destroy the battery and VOID THE WARRANTY.

g. Spray exposed terminals and connectors with several coats of battery terminal corrosion protection spray. (Mask surrounding areas to protect against overspray.)

h. For batteries which may be exposed to very wet environments (e.g. bilge mounted batteries) total encasement of the exposed terminals and connectors is necessary. However, do not block or cover the vents. **Allow ventilation.**

A battery terminal boot should be used. Install the boot on the cable before crimping the terminal. Fill the boot with petroleum jelly and fit over the sprayed connectors (as in "g" above).

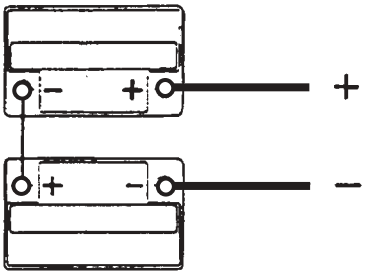
i. Battery charging in a boat requires a charger specifically designed for marine applications. In addition to battery gases, bilges often contain potentially dangerous fuel fumes. Follow all wiring and grounding recommendations of the charger manufacturer for on-board and on-shore connections. **Using a charger not specifically designed for marine applications or failure to follow the marine charger manufacturer's grounding and wiring recommendations could result in major corrosion damage to the hull or prop, and create a serious risk of electrical shock or fire, personal injury or death.**

Battery Installation

Note: In a multi-battery installation, it is often best to replace the entire set of batteries when one battery is weak or has failed.

Series

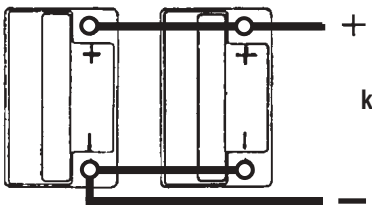
A "series" system increases the voltage, but keeps the battery capacity (cranking amps, amp hours, reserve minutes, and minutes running time) the same. Therefore, two 12-volt batteries connected in series (POS to NEG, NEG to POS) will deliver 24 volts at the same rating as one battery: During recharge, each battery receives the same amount of current; e.g. if the charger is putting out 10 amps, both batteries are getting 10 amps.



Series hookup increases voltage… 2 x 12V = 24 Volts

Parallel

A "parallel" system increases the capacity available, but keeps the voltage the same. Therefore, two 12-volt batteries with 400 CCA, 110 R.C. and 65 Ah will deliver 12 volts, 800 CCA, 220 R.C. and 130 Ah. (Actually, since each battery's load is lighter, the reserve capacity will more than double.)



Parallel hookup keeps same voltage… 2 x 12V = 12 Volts

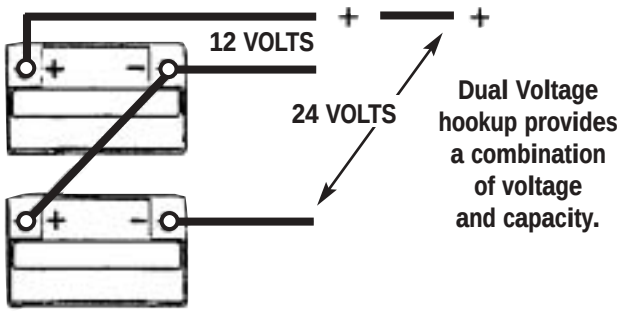
During recharge, the current (amps) is split between the batteries. The battery that is discharged the most will receive more current than the other until both are brought up to full charge.

Series/Parallel

A "series/parallel" system provides a combination of voltage and capacity for special applications. Note: Never mix different types and sizes of batteries in the same bank.

Dual Voltage

The illustration shows an arrangement that would supply 24 volts to a starter and 12 volts to the electronics (or vice versa).



To properly recharge, a sophisticated "battery isolator" should be installed. Otherwise, one battery will be continually overcharged and the other undercharged in a dual-voltage set-up.

IMPORTANT: Do not install any type of battery in a completely sealed box or enclosure. In the event of overcharging, the potentially explosive gasses must be allowed to escape.

UL Recognized Component

QUALITY SYSTEM CERTIFIED TO ISO 9001 ISO/TS 16949

MEMBER OF:

Battery Council International

ABYC AMERICAN BOAT & YACHT CLUB

IBMA INDEPENDENT BATTERY MANUFACTURERS ASSOCIATION

NMMA NATIONAL MARINE MANUFACTURERS ASSOCIATION

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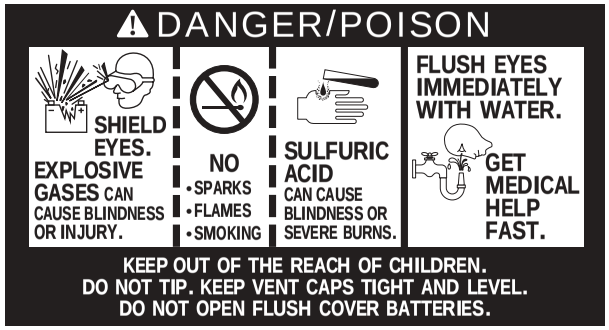
RECYCLING IS CRITICAL

Did you know lead-acid batteries are virtually 100% recyclable? They have a higher recycling rate than other waste products such as aluminum, paper, glass and plastic.
Be sure to return your lead-acid batteries to a dealer.
In most states it is illegal to discard a battery in the trash.

BE CAREFUL!

WARNING: Batteries produce explosive gases. Keep sparks, flames, and cigarettes away from batteries at all times. Protect your eyes at all times. Never lean over battery when jumping or performing other maintenance. Remember... <u>always wear safety glasses</u> when working around batteries!


⚠ DANGER/POISON
SHIELD EYES. EXPLOSIVE GASES CAN CAUSE BLINDNESS OR INJURY.
NO
•SPARKS
•FLAMES
•SMOKING
SULFURIC ACID CAN CAUSE BLINDNESS OR SEVERE BURNS.
FLUSH EYES IMMEDIATELY WITH WATER.
GET MEDICAL HELP FAST.
KEEP OUT OF THE REACH OF CHILDREN.
DO NOT TIP. KEEP VENT CAPS TIGHT AND LEVEL.
DO NOT OPEN FLUSH COVER BATTERIES.

TYPES OF MARINE / RV BATTERIES

The various types of batteries used in Marine and RV service are:

- Maintenance-Free Non-Accessible Engine Starting with no filler caps
- Low-Maintenance Accessible Starting with filler caps
- Dual Purpose (Starting/ Cycling) with filler caps
- Deep Cycle with filler caps

You may have one or more of the same type or different types on board your boat or RV. Determine which type of battery or batteries you have and follow the correct set of instructions.

SERVICE TIPS

<u>Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.</u>

1. Perform a visual inspection. Inspect for defective or cracked case and cover, and loose or damaged terminal posts or cables. <u>Replace battery and/ or cables immediately if any damage is found.</u>

SERVICE TIPS *(continued)*

Look for loose connections or hold-downs. Tighten snugly if appropriate. DO NOT OVER-TIGHTEN TO AVOID BATTERY DAMAGE!

2. Keep the batteries and battery compartment clean and corrosion free. Dirty, corroded batteries can self-discharge, which will affect performance and life.

   Clean corrosion with a paste made from baking soda and water. Apply liberally. Any corrosion is neutralized when the solution stops bubbling. Wash off with large quantities of water to avoid environmental damage.

3. Shine lead posts and terminal ends with a wire brush or steel wool to clean corrosion and assure a low resistance connection. Reassemble and coat lead parts with petroleum jelly or a terminal protection spray.

   Repaint hold-down, tray and surrounding parts if necessary.

CHECK THE STATE OF CHARGE

<u>Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.</u>

- **MAINTENANCE-FREE NON-ACCESSIBLE TYPES, WITH NO FILLER CAPS:**

  1. Check the state-of-charge of the battery with a voltmeter. If the reading is above 12.4 volts, the battery is at least 75% charged and should be OK. If below 12.4 volts, see the *Charging Tips* section.

- **ACCESSIBLE TYPES, WITH FILLER CAPS:**

  1. Using a voltmeter: Check the state-of-charge of the battery. If the reading is above 12.4 volts, the battery is at least 75% charged and should be OK. If below 12.4 volts, see the Charging Tips Section. *Or,*

  2. Using a hydrometer: Check the state-of-charge of the battery by taking a reading from one cell. Use a different cell each time. If the reading is above 1.225 specific gravity, the battery is at least 75% charged and should be OK. If below 75%, see the *Charging Tips* section.

     <u>Be careful of the sulfuric acid in the battery.</u> It can burn eyes, clothing and damage paint and electronic equipment. **FLUSH EYES IMMEDIATELY WITH LARGE QUANTITIES OF COOL WATER. GET MEDICAL HELP FAST.**

     Specific gravity readings need to be corrected to 80ºF (27ºC) to allow for temperature of the electrolyte and to insure accurate readings. For each 10 degrees above 80ºF (27ºC), add four points to the hydrometer reading.

CHECK THE STATE OF CHARGE *(continued)*

For each 10 degrees below 80ºF (27ºC), subtract four points to the hydrometer reading. For example, at 90ºF (32ºC) a hydrometer reading of 1.250 would be corrected to 1.254. Likewise, at 70ºF (21ºC) a hydrometer reading of 1.250 would be corrected to 1.246.

If the electrolyte level is too low to read with a hydrometer, add distilled water as noted below and run the engine or equipment at least two hours to mix the electrolyte and avoid a false reading.

3. Check electrolyte levels in all cells. If necessary, add distilled water (or clear, odorless drinking water). Do not use water with high iron content to avoid battery damage. **Never add acid, only water to a battery**. If it will be necessary to charge the battery, bring the levels in all cells to just above the separators inside the cells to allow for expansion during charging. Top off after charging as noted below.

   If it is not necessary to charge the battery, (or after charging) top off by filling each cell with distilled water to just below the filler tube in each cell.

LOAD TESTING

<u>Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.</u>

Using a voltmeter or hydrometer will tell you if your battery is charged. But these tests will not indicate if a battery can "hold a load." A battery can be fully charged, but be so weak or worn out that it can no longer perform its function of starting an engine or running accessory loads. Therefore, you must also perform a load test to determine the state of health of your battery.

1. Follow the instructions on the variable load tester or ask your favorite service dealer to load test your battery.
2. If the battery maintains a minimum "on load" voltage of 9.6 volts for 30 seconds, it is in good condition. If not, recharge and load test again.
3. If it fails a second time, **replace the battery immediately**.

CHARGING TIPS

Always leave filler caps in place, tight and secure to reduce the risk of battery explosion and serious injury! **Always wear safety glasses when working around batteries. Batteries can explode! Protect your eyes.** Do not charge batteries without proper instruction.

1. Batteries should be charged if hydrometer reading is below 1.225 specific gravity, or open circuit voltage is below 12.4 volts, or if the first load test is below 9.6 volts as noted previously.
2. Carefully read and follow the instructions that came with the charger to avoid serious injury, property damage and/or battery damage.
3. Unplug the charger before connecting or disconnecting a battery to avoid dangerous sparks which can cause a battery to explode.
4. Do not leave a battery on charge for more than 48 hours to avoid damaging the battery by over-charging. If gassing or spewing of electrolyte occurs, or the battery case feels hot, reduce or temporarily halt charging to avoid damaging the battery.
5. Stop the charge when two hydrometer or voltage readings recorded two hours apart indicate no increase. Further charging would be useless and may damage the battery and shorten its life. If the battery won't come up to full charge, replace it.
6. **NEVER attempt to charge a frozen battery.** To avoid explosion and serious injury, allow it to warm to 60°F (16°C) before charging.
7. **NEVER** leave a battery on a trickle charger longer than 48 hours. Serious damage to the battery WILL occur.

12 VOLT BATTERY CHARGING TIME TO FULL CHARGE @ 80°F

BATTERY VOLTAGE	SPECIFIC GRAVITY	STATE OF CHARGE	MAXIMUM RATE @ 50 AMPS	30 AMPS	20 AMPS	10 AMPS
12.6	1.265	100%	— FULL CHARGE —			
12.4	1.225	75%	20 min.	35 min.	48 min.	90 min.
12.2	1.190	50%	45 min.	75 min.	95 min.	180 min.
12.0	1.155	25%	65 min.	115 min.	145 min.	280 min.
11.8	1.120	0%	85 min.	150 min.	195 min.	370 min.

NOTE:

Times are approximate and depend upon battery condition, age and design, the efficiency of the charger, line voltage and other factors.

OFF-SEASON STORAGE

Batteries that are not in use during the off-season must be cared for as follows to extend battery life and reliability:

1. Disconnect the batteries to avoid self-discharge due to parasitic loads such as clocks, ground faults, etc.
2. Put into storage fully charged and keep them above 75% state-of-charge. Check state-of-charge every 90 days and recharge if necessary.
3. Ideally, store batteries in a cool, dry place with temperatures not below 32ºF (0ºC) or above 80ºF (27ºC). Typically, batteries will self-discharge at faster rates at higher temperatures. For example:

TEMPERATURE	SELF-DISCHARGE RATE
100ºF (38ºC)	.3 Pts. Specific Gravity per day
80ºF (27ºC)	.2 Pts. Specific Gravity per day
50ºF (10ºC)	.1/2 Pt. Specific Gravity per day
30ºF (–1ºC)	.1/10 Pt. Specific Gravity per day

NOTE:

This is only an example. Self-discharge may be higher or lower depending upon battery chemistry, lead alloys, age and other factors.

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California Proposition 65 Warning

Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the state of California to cause cancer and birth defects or other reproductive harm. **Wash hands after handling.**

Marine / RV Battery Care & Maintenance

- **STARTING**
- **DEEP-CYCLE**
- **DUAL PURPOSE**

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Deka®

– Material Safety Data Sheet –

Lead Acid Battery Wet, non-spillable (UN2800)

SECTION I

Manufacturer's Name:
East Penn Manufacturing Co., Inc.
Deka Road, Lyon Station, PA 19536
Telephone Number for Information: (610) 682-6361
Emergency Telephone Number: CHEMTREC: 1-800-424-9300,
In Washington D.C. or outside continental U.S., call 1-202-483-7616

Date: January 29, 2007

Trade Name: Gell; Absorbed Electrolyte, Sealed Valve Regulated Non Spillable Battery
Classification: Battery wet, non-spillable, electric storage UN2800

SECTION II
HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components Specific Chemical Identity (Common Name (s))	OSHA PEL	ACGIH TLV	Range Percent By Weight	Average
Lead, CAS #7439921	0.05 mg/m^3	0.05 mg/m^3	60-75%	67%
Sulfuric Acid, CAS #7664939	1.00 mg/m^3	1.00 mg/m^3	5-15%	10%
Antimony, CAS #7440360	0.50 mg/m^3	0.50 mg/m^3	0-0.1%	<0.1%
Arsenic, CAS #7440382	0.01 mg/m^3	0.01 mg/m^3	0.01 %	<0.1%
Polypropylene, CAS#9003070	N/A	N/A	2-10%	4%
Calcium, CAS#7440702	1.0 mg/m^3	1.0 mg/m^3	0-0.1%	<0.1%
Tin CAS #7440315	2.0 mg/m^3	2.0 mg/m^3	0-0.1%	<0.1%

SECTION III
PHYSICAL/CHEMICAL CHARACTERISTICS

Electrolyte (Sulfuric Acid):
Appearance and Odor: Clear, Odorless, colorless liquid
Boiling Point: 235 – 240^o F
Evaporation Rate (Butyl Acetate=1): less than 1.0
Melting Point: N/A

Solubility in Water: 100%
Specific Gravity (H_20=1): 1.270 – 1.330
Vapor Density (AIR=1): Greater than 1
Vapor Pressure (mm Hg): 10

SECTION IV
FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used): Non-Flammable
Extinguishing Media: Class ABC extinguisher,

Flammable Limits: *Hydrogen Gas
LEL: 4% **UEL** 74%

NOTE: CO_2 may be used, but not directly on the cell. The thermal shock may cause cracking of the battery case and/or cases.
*** Hydrogen gas may be generated during battery changing.**

SECTION V
REACTIVITY DATA

Stability: Stable **Condition to Avoid:** Prolonged overcharging, sources of ignition

Incompatibility (Materials to Avoid): Sulfuric Acid: Contact with combustibles and organic materials may cause fire and explosion. Also reacts violently with strong reducing agents, metals, strong oxidizers and water. Contact with metals may produce toxic sulfur dioxide fumes and may release flammable hydrogen gas.

Hazardous Decomposition of By-Products: Sulfuric Acid: Excessive overcharging or fire may create Sulfur trioxide, carbon monoxide, sulfuric acid mist, sulfur dioxide, and hydrogen.
Lead Compounds: Contact with strong acid or base or presence of nascent hydrogen may generate highly toxic arsine gas.

SECTION VI
HEALTH HAZARD DATA

Route(s) of Entry: Not Applicable under normal use.

Carcinogenicity:
Sulfuric Acid: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mist containing sulfuric acid" as a Category 1 carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid contained within a battery. Inorganic acid mist (sulfuric acid mist) is not generated under normal use of this product. Misuse of the product such as overcharging, may result in the generation of sulfuric acid mist.
Lead Compounds: Lead is listed as a 2B carcinogen, likely in animals at extreme doses. Proof of carcinogenicity in humans is lacking at present.
Arsenic: Listed by National Toxicology Program (NTP), IARC, OSHA and NIOSH as a carcinogen only after prolonged exposure at high levels.

Signs and Symptoms of Exposure: Avoid contact, with absorbed electrolyte (sulfuric acid) may cause irritation of eyes, nose and throat. Contact with eyes and skin causes irritation and skin burns. Absorbed electrolyte is corrosive.

Medical Conditions Generally Aggravated by Exposure: Pregnant women and children must be protected from lead exposure.

Health Hazards (Acute and Chronic): Do not open battery, avoid contact with internal components. Internal components include lead and absorbed electrolyte. Electrolyte is corrosive and contact may cause skin irritation and chemical burns.

Emergency and First Aid Procedures: (contact with electrolyte)

1) Flush contacted area with large amounts of water for at least 15 minutes. Remove contaminated clothing and obtain medical attention if necessary. Eye wash and/or emergency shower should be readily available.
2) If swallowed, give large volumes of water. **DO NOT** induce vomiting, obtain medical treatment.

SECTION VII
PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Electrolyte material is corrosive. Contains sulfuric acid. Neutralize any spilled material. Reference 1996 North American Emergency Response Guidebook, #154.

Waste Disposal Method: Lead-acid batteries are completely recyclable. For information on returning batteries to East Penn for recycling, contact your East Penn Representative. Dispose of any collected material in accordance with local, state or applicable federal regulations.

Precautions to be Taken in Handling and Storing: Store away from reactive material as defined in Section V, Reactivity Data. Place cardboard between layers of stacked batteries to avoid damage and short circuit. Do not allow metallic materials to simultaneously contact both terminals.

Other Precautions: If battery case is broken, avoid direct contact with internal components. Keep away from ignition sources during charging.

SECTION VIII
CONTROL MEASURES

Respiratory Protection (Specific Type): N/A

Ventilation: Must be provided when charging in an enclosed area.

Protective Gloves: Recommended

Eye Protection: Recommended

Other Protective Clothing or Equipment: N/A

Work Hygienic Practices: Good Personal hygiene and work practices are recommended.

SECTION IX
OTHER REGULATORY INFORMATION

NFPA Hazard Rating	**Sulfuric Acid**	**Lead**
Health (Blue)	3	3
Flammability (Red)	0	0
Reactivity (Yellow)	2	0

Note: Sulfuric acid is water-reactive if concentrated.

U.S. DOT: Batteries, wet, non-spillable, electric storage

Hazard Class/Division	8
ID Number	UN2800
Packing Group	III
Label Requirements	Corrosive

RCRA: Spent lead-acid batteries are not regulated as hazardous waste when recycled. Spilled sulfuric acid is a characteristic hazardous waste, EPA hazardous waste number D002 (corrosivity).

CERCLA (Superfund) and EPCRA (Emergency Planning and Community Right to Know ACT)

a) Reportable Quantity (RQ) for spilled 100% sulfuric acid is 1000 lbs.

b) Sulfuric acid is a listed "Extremely Hazardous Substance" under EPCRA with a Threshold Planning Quantity (TPQ) of 1000 lbs.

c) Batteries are subject to EPCRA reporting requirements under sections 302/304, 311/312, and 313.
Reporting quantities are as follows:
Lead: section 311/312 = 10,000 lbs.
Title II I section 313 = 100 lbs.
Sulfuric Acid: section 311/312 = 500 lbs.
Title III section 313 = 500 lbs.

California Prop 65: Batteries, battery posts, terminals and related accessories contain lead and lead compounds, and other chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. **WASH HANDS AFTER HANDLING.**

For additional information concerning East Penn Manufacturing Co., Inc. products or questions concerning the content of this MSDS please contact your East Penn representative.

This information is accurate to the best of East Penn Mfg. Co.'s knowledge or obtained from sources believed by East Penn to be accurate. Before using any product, read all warnings and directions on the label.

MOHAWK

OPTIONS

MP-18-24VDC-SERIES

ELECTRIC/HYDRAULIC PORTABLE LIFT

CHASSIS LIFTING BEAM

See next page for chassis beam diagram and specifications.

If it is desired to raise a vehicle by the frame, this can be done by using optional chassis lifting beams. The chassis lift beam fits into the cradle where the tire would normally fit and spans between a pair of posts. The beam comes with lifting pads and height adapters that slide and stack along the beam to accommodate the frame pick up points.

Directions for Use:
Drive vehicle into bay.
Roll chassis beam under desired end of vehicle where frame pick points are.
Slide pads to desired positions and stack adapters as desired to accommodate frame pick points.
Roll posts to each end of chassis beam, cradling ends of chassis beam with forks.
Lift pair until chassis beam contacts frame.
Verify proper frame engagement.
Check other posts for proper engagement of tires or frame (depending on if another chassis beam is used or the other end is lifted by tires)
Operate lift as desired.

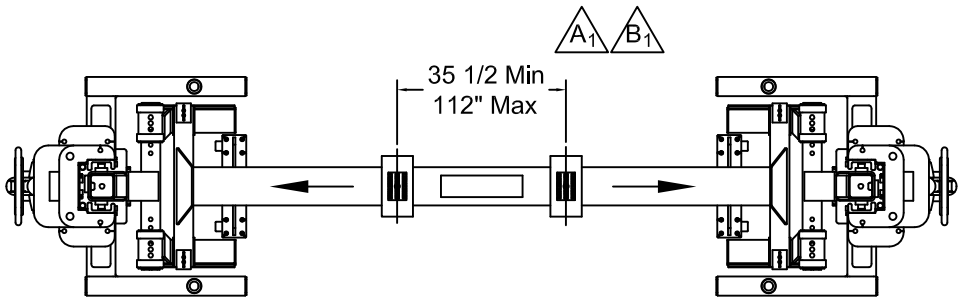
NOTICE:
The chassis beam is rated for 35,000 lbs total.
Always ensure that the beams are cradled in the forks as close as possible to the carriages. (Do not place beams on tips of forks) Also, ensure that vehicle is centered on chassis beam to ensure even loading of beam and posts.
This beam is intended to be used in conjunction with another beam or another set of mobile column posts to lift the entire vehicle. Do not use this beam to pick up just one end of a vehicle only. Load beam only on lifting pads, do not load beam on center.
This beam is intended for use on Mohawk MP-Series 15” Long Fork lifts ONLY.

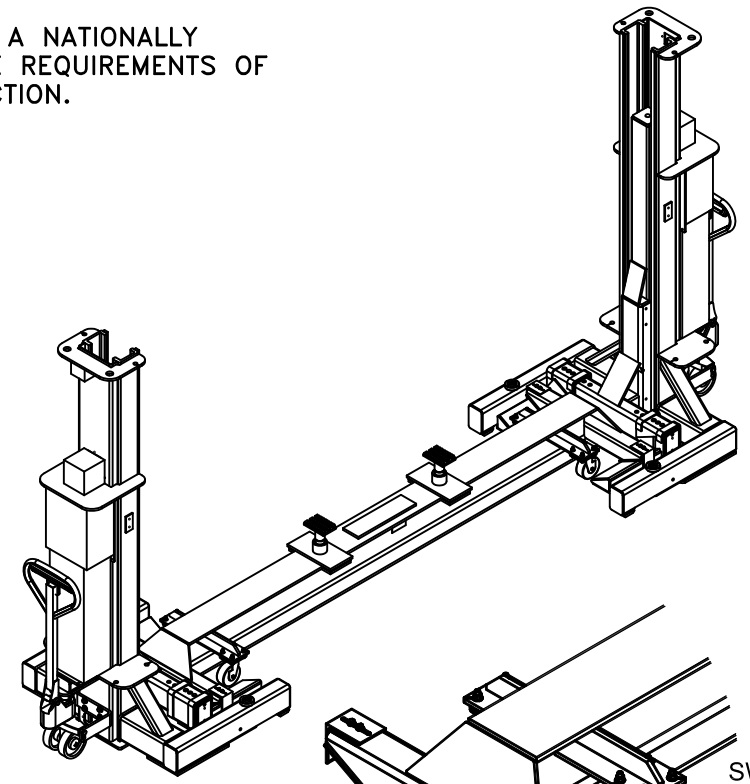
Refer to the ANSI standard “Vehicle Lift Points for Service Garage Lifting,” ANSI/SAE J2184-Oct92, safety manual “Lifting if Right,” ALI/SM01, and “Vehicle Lifting Points Guide” ALI/LP-Guide for proper positioning of vehicles on lift.

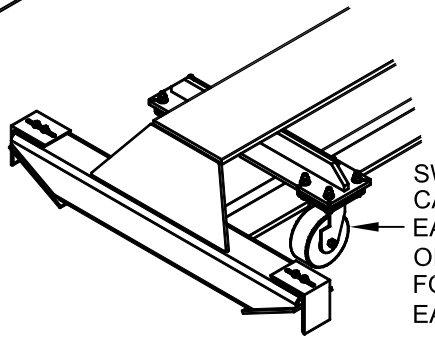
#	DESCRIPTION	DATE	APPROVED
B	1. DIM WAS 35 1/2 MIN/112 MAX	04/01/2010	rwv7089
	2. DIM WAS 18 MIN/24 MAX		

#	DESCRIPTION	DATE	APPROVED
A	1) WAS 36 1/2 MIN, 112" MAX	05/30/2006	dak0879
	2) WAS 17 1/2 MIN, 23 1/2 MAX		

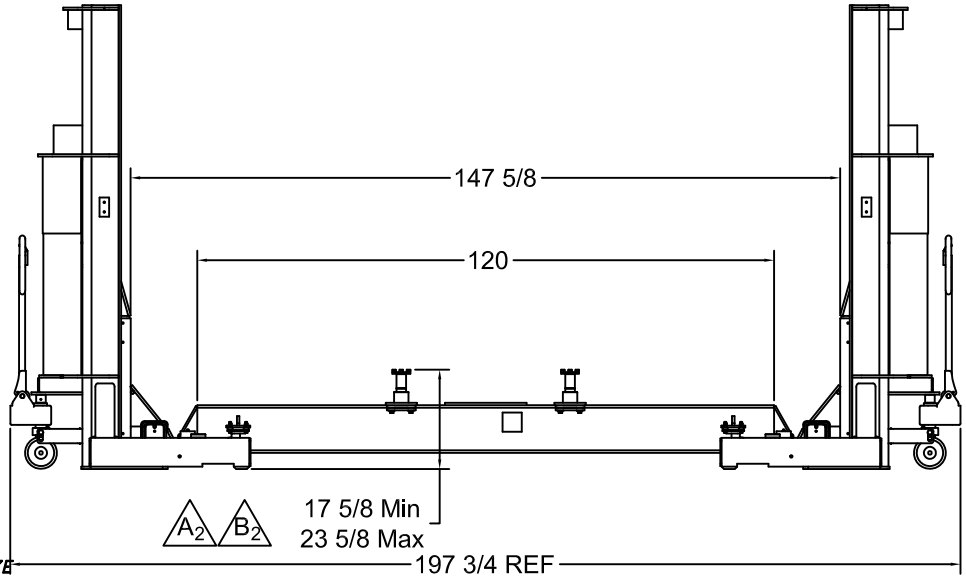
THIS ACCESSORY HAS BEEN TESTED AND CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) TO MEET THE REQUIREMENTS OF ANSI/ALI ALCTV–2011 FOR AUTOMOTIVE LIFT CONSTRUCTION.







SWIVEL CASTERS ON EACH END OF BEAM FOR POSITIONING EASE



Chassis Lifting Beam

These beams can be rolled on the floor between to Mohawk MP-Series mobile lifts and lifted by the column forks. Beams include twin lifting pads to engage vehicle chassis.

Capacity: 35,000 lbs per beam
(35,000 lbs per post pair)

C–SIZE

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NOTES:
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2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E–70XX ELECTRODES OR E–70TI CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP–18 Options.dwg*

NEXT ASSEMBLY

SCALE *1/16*	DRAWN *rwv7089*	**MOHAWK RESOURCES LTD.**	
CHECKED	APPROVED	TITLE *Mobile Post Lift Chassis Beam*	
DATE *8/2005*	WEIGHT *~500* LB.	FROM *n/a*	DRAWING NUMBER *MP–2300–Spec* B

WING PLOW ADAPTERS

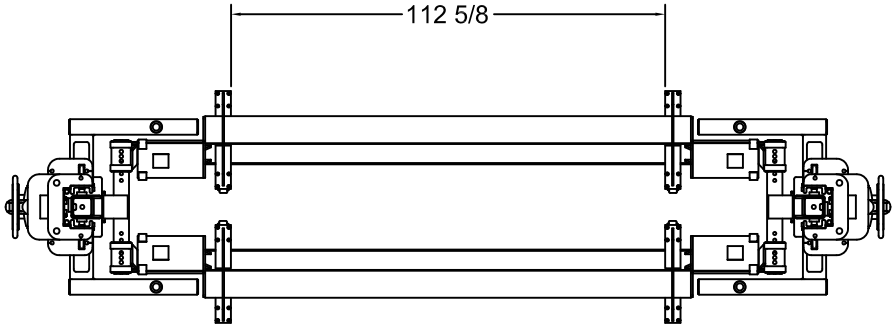
See next page for wing plow adapter diagram and specifications.

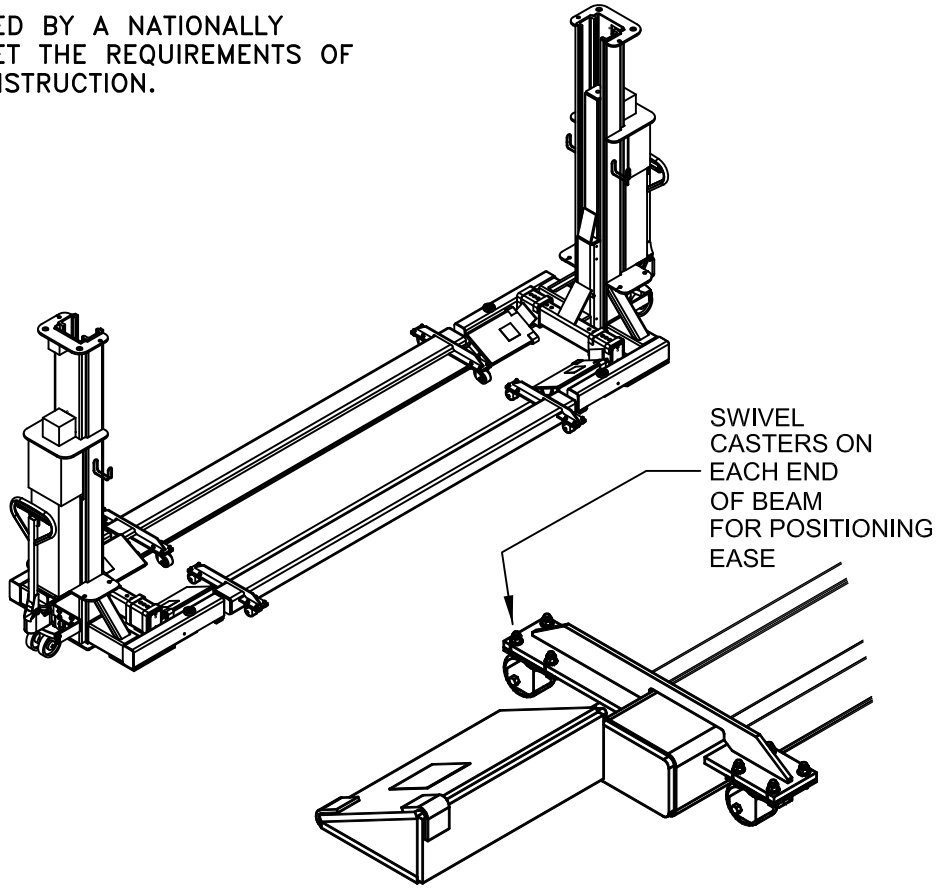
The wing plow adapters are to be used when it is desired to raise a vehicle with side wing plows or RV's with side extensions where the forks are not able to get close to the tires. The wing plow adapters are used with a pair of posts to enable lifting of the whole front axles of a vehicle by the tires.

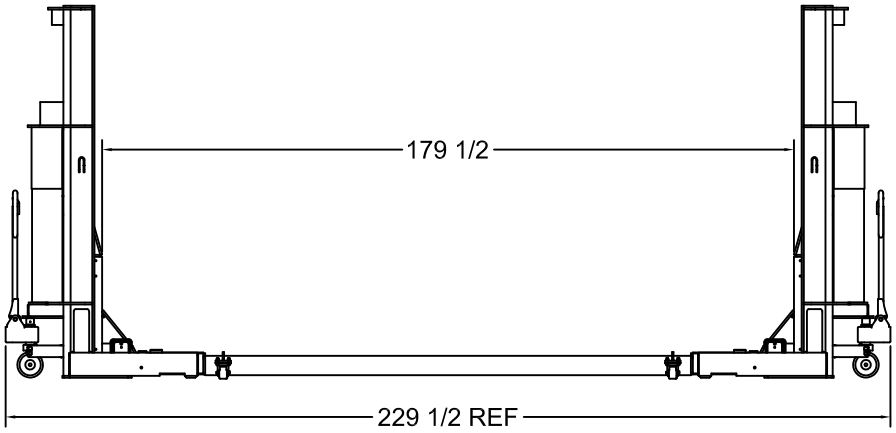
Directions for Use:
Drive vehicle into bay.
Roll wing plow adapters around each side of front axle tires (center tires on beam lengths).
Roll posts to each end of adapters, inserting forks fully into adapter sockets.
Lift pair until wing plow adapters engaged tires.
Verify proper engagement.
Check other posts for proper engagement of tires.
Operate lift as desired.

NOTICE:
The wing plow adapters are rated for 25,000 lbs total (per pair of beams, see spec on next page) Always ensure that the wing plow adapters are fully inserted over the lifting forks. Also, ensure that vehicle is centered on the wing plow adapters to ensure even loading of beams and posts.
These adapters are intended to be used in conjunction with another set of mobile column posts to lift the entire vehicle. Do not use these to pick up just one end of a vehicle only. These adapters are designed to lift only tires and must not be top loaded. Do not use these to pick up vehicles by frames. Use adapters only in pairs. These adapters must not be single loaded.
The wing plow adapters are intended for use on Mohawk MP-Series 15" Long Fork lifts ONLY.

THIS ACCESSORY HAS BEEN TESTED AND CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) TO MEET THE REQUIREMENTS OF ANSI/ALI ALCTV-2011 FOR AUTOMOTIVE LIFT CONSTRUCTION.







Wing Plow Beam Adapters

A.K.A. RV SLIDE OUT ADAPTERS

These beams can be rolled on the floor between two Mohawk MP-Series mobile lifts and lifted by the column forks. Beams are used in pairs to engage a full set of tires in the same manner that the lifting forks would. Length of beam gives lift the ability to raise plows with side wing plows or RV's with side extensions.

Capacity: 25,000 lbs per Post Pair

C-SIZE

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NOTES:
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3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP-18 Options.dwg*

NEXT ASSEMBLY

SCALE *1/16*	DRAWN *rwv7089*	**MOHAWK RESOURCES LTD.**	
CHECKED	APPROVED	TITLE *Mobile Post Lift Wing Plow Beam Adapters*	
DATE *8/2005*	WEIGHT *~1200* LB.	FROM *n/a*	DRAWING NUMBER *MP-2400-Spec*

FORK TRUCK ADAPTERS

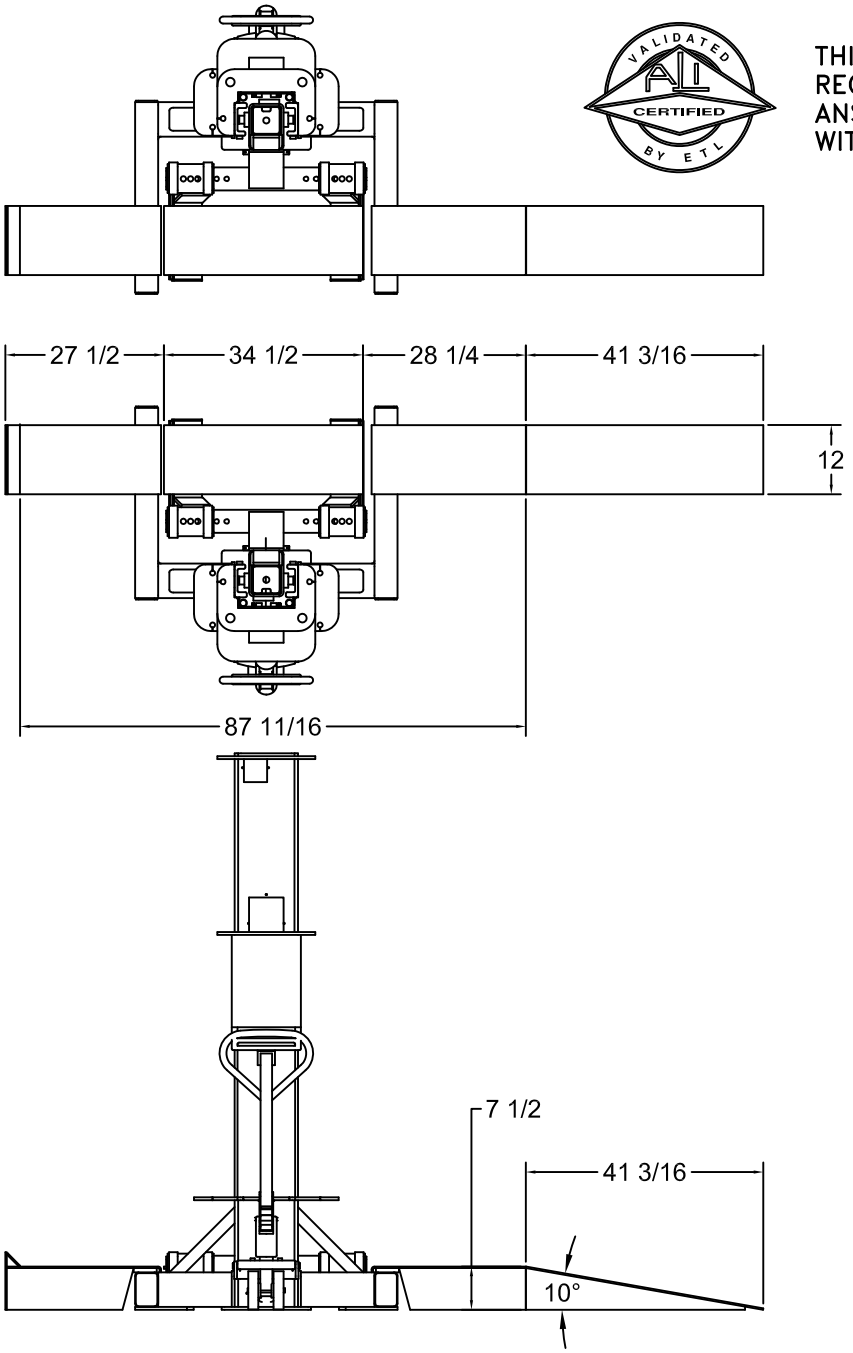
See next page for fork truck adapter diagram and specifications.

The fork truck adapters are to be used when it is desired to raise a fork truck by the undercarriage for wheels free servicing. The fork truck adapters are used with a pair of posts.

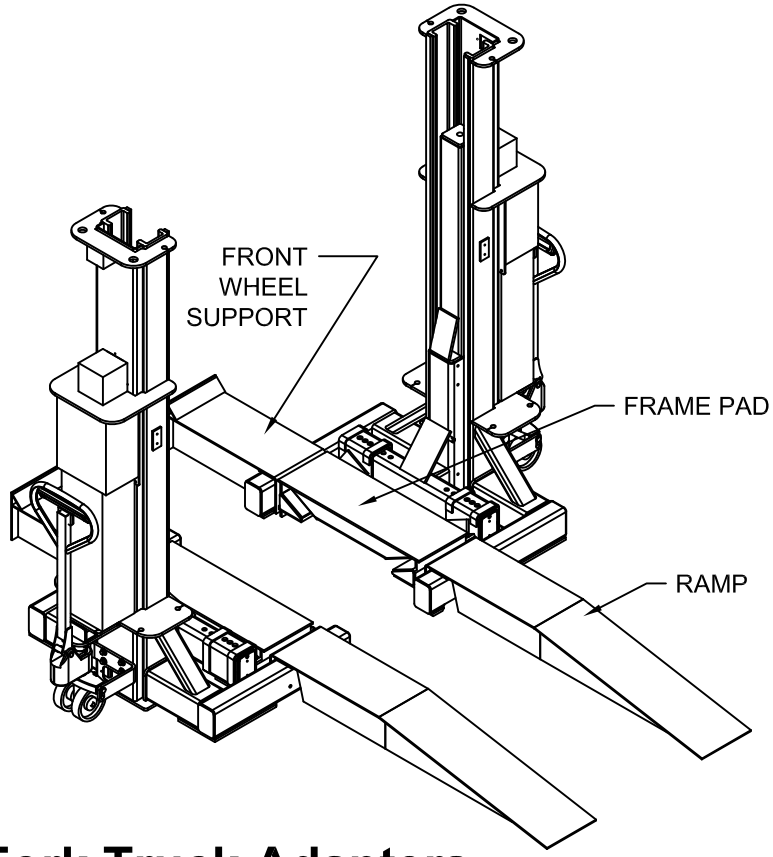
Directions for Use:
Locate a pair of posts (Master and Slave) in the desired lifting location.
Assembly ramps and pads onto posts as shown in specification diagram.
Drive fork truck onto pads until center of gravity of fork truck is at center of pad.
Locate rubber blocks as desired to contact frame.
Lift pair until fork truck pad engaged fork truck frame.
Verify proper frame engagement with pads.
Lift pair approximately 6 inches verifying that truck center of gravity is centered on pad.
Shake truck slightly to ensure secure and balanced support of frame.
Operate lift as desired.

WARNING:
Any removal of components from vehicle while raised may alter the center of gravity of the vehicle and produce an unsafe or unstable condition of the vehicle or the lifting system that may cause injury to personnel or damage to equipment. Ensure vehicle center of gravity is always located at center of lifting pads. Use jack stands as an added measure of safety to ensure load stabilization.

NOTICE:
The fork truck adapters are rated for 14,000 lbs per post (28,000 lbs per post pair).
Always ensure that the fork truck adapter pads are fully inserted over the lifting forks inboard against fork tubes. (not on tips of forks). Also, ensure that fork truck center of gravity is centered on the adapter pads to prevent offset loading of posts.
Do not use these to pick up just one end of a vehicle only. Do not use these to pick up vehicles by tires. Use adapters only in pairs. These adapter are designed only to pick up fork trucks.
The fork truck adapters are intended for use on Mohawk MP-Series 15” Long Fork lifts ONLY.



THIS ACCESSORY HAS BEEN TESTED AND CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL) TO MEET THE REQUIREMENTS OF ANSI/ALI ALCTV–2011 FOR AUTOMOTIVE LIFT CONSTRUCTION. FOR USE WITH MOHAWK MP–SERIES LIFTS WITH 15" FORKS.



Fork Truck Adapters

These adapters consist of 2 ramps, 2 frame pads and 2 front wheel supports that set on top of the standard Mohawk MP-series mobile lift forks. As the lift raises, the frame pads are lifted by the forks while the ramps and front wheel supports stay on the floor.

Capacity: 14,000 lbs per pad (per post)
(28,000 Lbs Total per set)

C–SIZE

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TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP–18 Options.dwg*

NEXT ASSEMBLY

SCALE *1/16*	DRAWN *rwv7089*	**MOHAWK RESOURCES LTD.**	
CHECKED	APPROVED	TITLE *Mobile Post Lift Fork Truck Adapters*	
DATE *8/2005*	WEIGHT *~550* LB.	FROM *n/a*	DRAWING NUMBER *MP–2200–Spec*

HMMWV ADAPTERS

See next page for HMMWV adapter diagram and specifications.

The HMMWV adapters are specifically to be used when it is desired to raise a HMMWV (Hummer) by the front and rear bumpers for wheels free servicing. These adapters can also be used to pick up mobile military generators, a/c units, etc. These adapters are used with a pair of posts.

Directions for Use:
Drive the vehicle into the lifting area.
Slip the HMMWV adapters over the forks of a master and slave post.
Drop the fork retainer pins in the holes at the carriages.
Locate posts at the front and rear of the vehicle.
Locate lifting pads at desired locations to contact frame at bumper ends.
Ensure pads are at widest settings possible.
Lift pair until pads engaged frame.
Verify proper frame engagement with pads.
Lift pair approximately 6 inches.
Shake truck slightly to ensure secure and balanced support of frame.
Operate lift as desired.

WARNING:
Any removal of components from vehicle while raised may alter the center of gravity of the vehicle and produce an unsafe or unstable condition of the vehicle or the lifting system that may cause injury to personnel or damage to equipment. Ensure vehicle center of gravity is always located at center of lifting pads. Use jack stands as an added measure of safety to ensure load stabilization.

NOTICE:
The HMMWV adapters are rated for 12,000 lbs per post (24,000 lbs per post pair)
Always ensure that the HMMWV adapters are fully inserted over the lifting forks and retaining pins are inserted into carriage holes. Also, ensure that HWWMV center of gravity is centered on the between the pads to prevent offset loading of posts.
Do not use these to pick up just one end of a vehicle only. Use adapters only in pairs.
The HMMWV adapters are intended for use on Mohawk MP-Series 15” Long Fork lifts ONLY.

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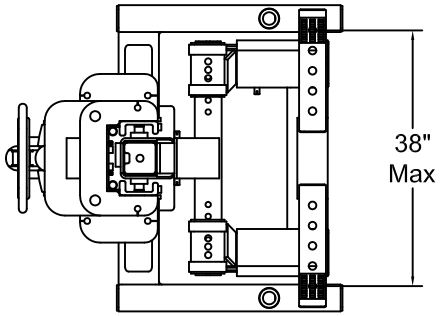

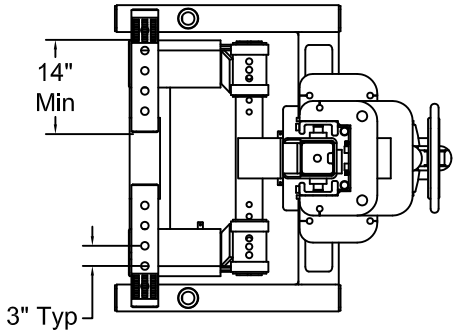

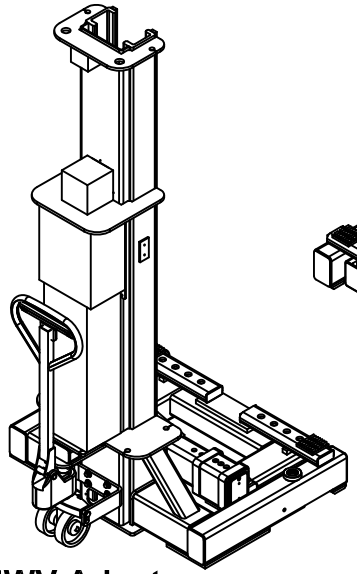

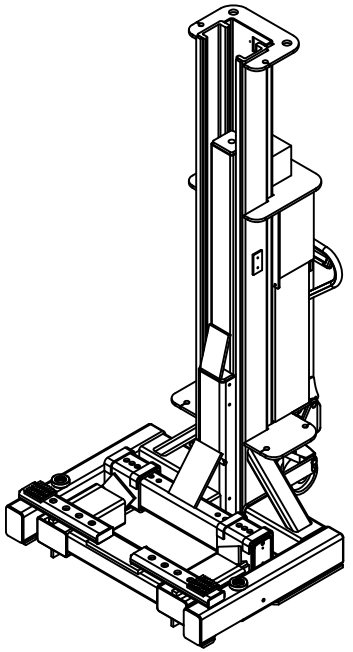

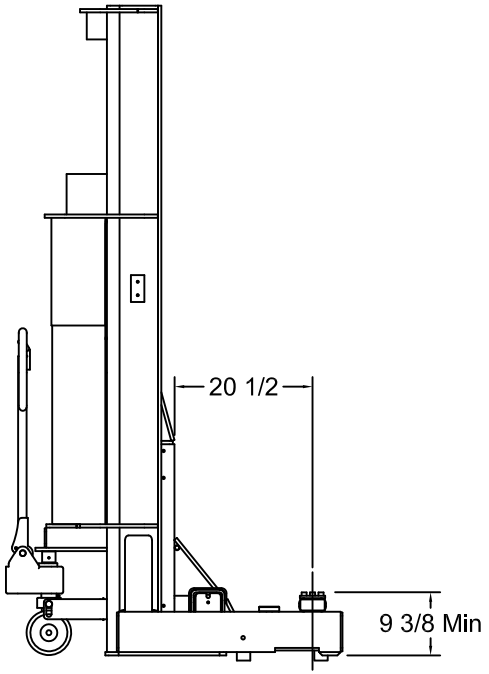

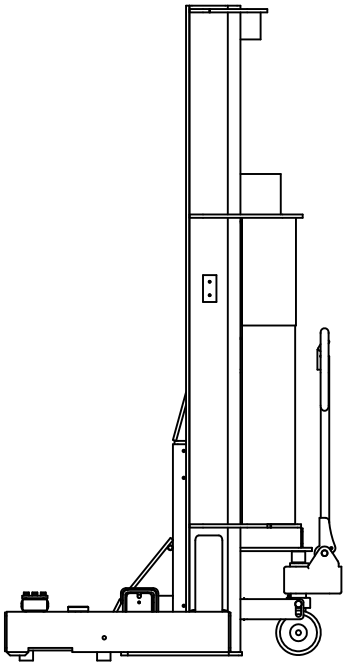

HMMWV Adapters

A.K.A. FRONT TO REAR BUMPER ADAPTERS
A.K.A. U.S.A.F GENERATOR ADAPTER

These adapters slip over the standard forks of the Mohawk MP-18 Series lifts and convert the lift into a "2-Post Frame Engaging Lift". They can also be used to pick by the bumpers. Designed specifically for military HMMWV's.

Capacity:	12,000 lbs per post (24,000 Lbs Total)
Accessories include:	(4) Lifting Pads, Square (4) Lifting Pads, Square, 1" (4) Lifting Pads, Square, 2" (4) 3" Height Adapters (4) 6" Height Adapters

C-SIZE

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NOTES:
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3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME: MP-18 Options.dwg

NEXT ASSEMBLY

SCALE 1/16	DRAWN rwv7089	MOHAWK RESOURCES LTD.	
CHECKED	APPROVED	TITLE Mobile Post Lift HMMWV Adapters	
DATE 8/2005	WEIGHT ~550 LB.	FROM n/a	DRAWING NUMBER MP-2500-Spec

FRAME CONTACT ADAPTERS

See next page for Frame Contact Adapters diagram and specifications.

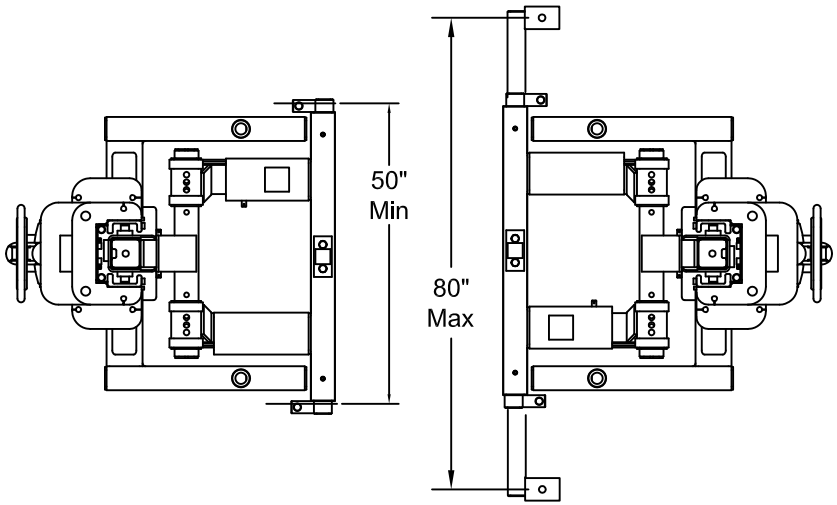
The frame contact adapters are designed to convert a mobile column lift post pair into a frame engaging lift for wheels free servicing. These adapters are used with a pair of posts.

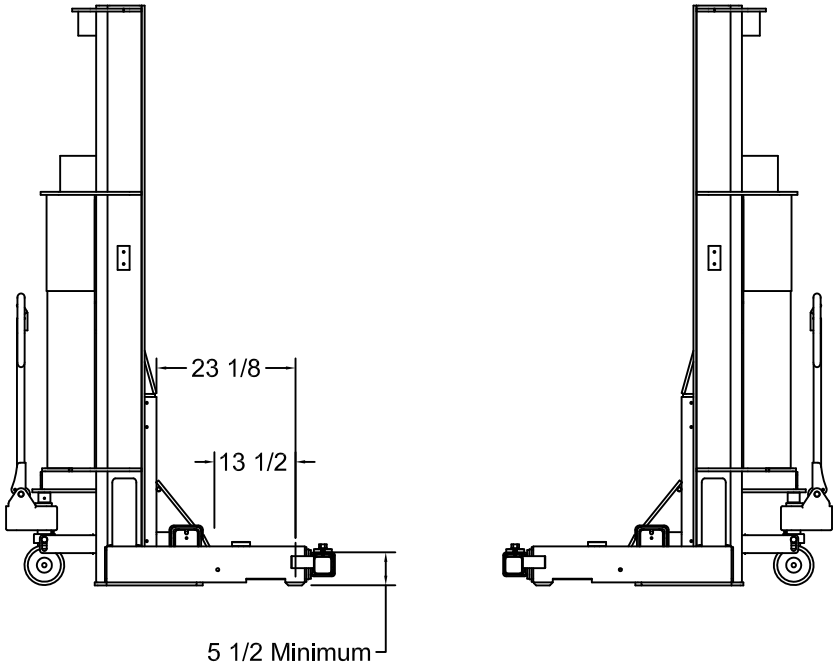
Directions for Use:
Drive the vehicle into the lifting area.
Slip the frame contact adapters over the forks of a master and slave post.
Drop the fork retainer pins in the holes at the carriages.
Locate posts at the both sides of the vehicle.
Locate lifting pads at desired locations to contact frame pick up points.
Ensure pads are at widest settings possible for stability.
Lift pair until pads engaged frame.
Verify proper frame engagement with pads.
Lift pair approximately 6 inches.
Shake truck slightly to ensure secure and balanced support of frame.
Operate lift as desired.

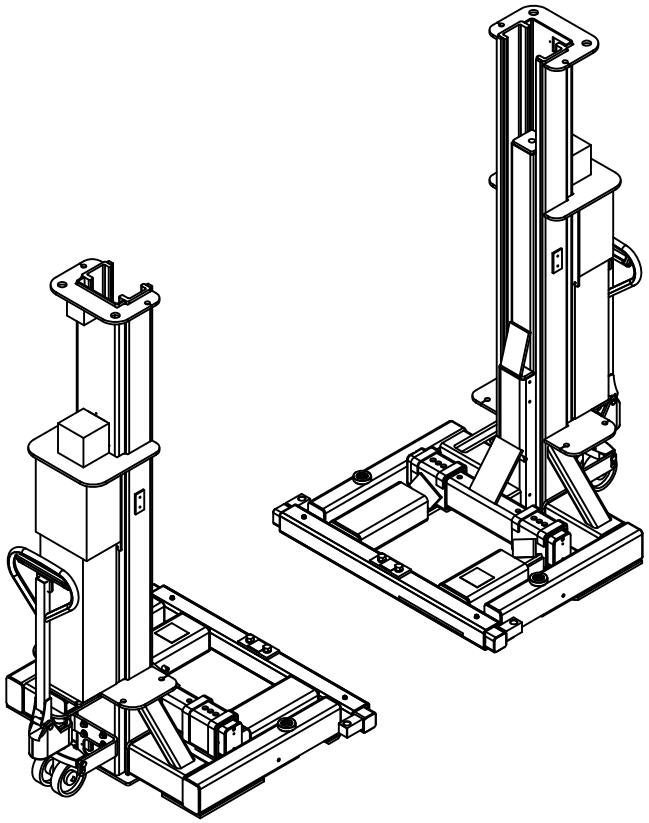
WARNING:
Due to the nature of this design where loading of the adapters is outside the base envelope of the posts, this is a non-certifiable option and voids the certification on the lift it is used on.

WARNING:
Any removal of components from vehicle while raised may alter the center of gravity of the vehicle and produce an unsafe or unstable condition of the vehicle or the lifting system that may cause injury to personnel or damage to equipment. Ensure vehicle center of gravity is always centrally located between the lifting pads. Use jack stands as an added measure of safety to ensure load stabilization.

NOTICE:
The frame contact adapters are rated for 4,000 lbs per post (8,000 lbs per post pair)
Always ensure that the frame contact adapters are fully inserted over the lifting forks and retaining pins are inserted into carriage holes. Also, ensure that vehicle center of gravity is centered between the pads to prevent offset loading of posts.
Do not use these to pick up just one end of a vehicle only. Use adapters only in pairs.
The frame contact adapters are intended for use on Mohawk MP-Series 15” Long Fork lifts ONLY.







Auto Frame Contact Adapters

These adapters slip over the standard forks of the Mohawk MP-18 Series lifts and convert the lift into a "2-Post Frame Engaging Lift".

Capacity:	4,000 lbs per Post (8,000 lbs Total per Post pair)
Accessories include:	(4) Lifting Pads (4) 3" Height Adapters (4) 6" Height Adapters

Note: Due to the nature of this design extending beyond the base frame of the posts, this is NOT a certified option and use of this option on a certified lift void the certification of the lift.

C-SIZE

NOTICE OF CONFIDENTIAL INFORMATION

INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND PROPERTY OF MOHAWK RESOURCES LTD.. WHERE DRAWING IS FURNISHED TO OTHERS IT SHALL BE USED SOLELY FOR PURPOSES OF INSPECTION, INSTALLATION, OR MAINTENANCE. THE INFORMATION SHALL NOT BE USED OR DISCLOSED BY THE RECIPIENT FOR ANY OTHER PURPOSES WHATSOEVER.

NOTES:
1. REMOVE ALL SHARP CORNERS & EDGES.
2. UNLESS OTHERWISE SPECIFIED, SURFACE FINISH TO BE 125 RMS.
3. WELDING MEDIUM SHALL CONFORM TO AWS SPECIFICATIONS TO E-70XX ELECTRODES OR E-70T1 CODE 5.3 FLUX CORE WIRE ONLY.

TOLERANCES:
ANGULAR ± 1°
FRACTIONAL ± .030
DECIMAL:
0.XX ± .030
0.XXX ± .005

FILE NAME *MP-18 Options.dwg*

NEXT ASSEMBLY

SCALE *1/16*	DRAWN *rwv7089*	**MOHAWK RESOURCES LTD.**	
CHECKED	APPROVED	TITLE *Mobile Post Lift Frame Contact Adapters*	
DATE *8/2005*	WEIGHT *~500* LB.	FROM *n/a*	DRAWING NUMBER *MP-2100-Spec*